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ABSTRACT

This guide is designed to provide and/or improve instruction for occupational training in the area of snowmobile repair, and includes eight areas. Each area consists of one or more units of instruction, with each instructional unit including some or all of the following basic components: Performance objectives, suggested activities for teacher and students, information sheets, assignment sheets, job sheets, visual aids, and tests and test answers. (Units are planned for more than one lesson or class period of instruction.) The eight areas (and their respective units) are Steering Systems (Skis, Steering); Drive Belts and Clutches (Engine Clutches, Drive Belts, Drive Belt Adjustment and Alignment, Drive Clutch Assembly, Drive Clutch Bearing Replacement); Chain Drives (Chain Case Assemblies, Chain Replacement, Chain Repair); Axles (Drive Axles, Rear Axles); Suspensions (Bogie Wheels, Slide Rail Suspension; Brakes (Shoe Type Brake Servicing, Disc Type Brake Servicing, Hydraulic Type Brake Servicing); Tracks (Track, Track Replacement); and Shocks (Shock Absorbers). (WL)

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SNOWMOBILE REPAIR

WRITTEN BY
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Developed by the
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA
for the
MID-AMERICA VOCATIONAL CURRICULUM CONSORTIUM, INC.

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TABLE OF CONTENTS

Steering Systems (Section A)

Unit I	Skis	S - 1-A
Unit II	Steering	S - 25-A

Drive Belts and Clutches (Section B)

Unit I	Engine Clutches	S - 1-B
Unit II	Drive Belts	S - 25-B
Unit III	Drive Belt Adjustment and Alignment	S - 59-B
Unit IV	Driven Clutch Assembly	S - 75-B
Unit V	Drive Clutch Bearing Replacement	S - 93-B

Chain Drives (Section C)

Unit I	Chain Case Assemblies	S - 1-C
Unit II	Chain Replacement	S - 21-C
Unit II	Chain Repair	S - 37-C

Axles (Section D)

Unit I	Drive Axles	S - 1-D
Unit II	Rear Axles	S - 19-D

Suspensions (Section E)

Unit I	Bogie Wheels	S - 1-E
Unit II	Slide Rail Suspension	S - 17-E

Brakes (Section F)

Unit I	Shoe Type Brake Servicing	S - 1-F
Unit II	Disc Type Brake Servicing	S - 15-F
Unit III	Hydraulic Type Brake Servicing	S - 31-F

Tracks (Section G)

Unit I	Track	S - 1-G
Unit II	Track Replacement	S - 23-G

Shocks (Section H)

Unit I	Shock Absorbers	S - 1-H

PREFACE

For many years those responsible for teaching small engine repair have felt a need for instructional materials to use in this area. A team of teachers, industry representatives and trade and industrial education staff members accepted this challenge and have produced a manual which will meet the needs of many types of courses where students are expected to become proficient in the snowmobile area of small engine repair.

Instructional material in this publication is written in terms of student performance using measurable objectives. This is an innovative approach to teaching that accents and augments the teaching-learning process. Criterion referenced evaluation instruments are provided for a uniform measurement of student progress. In addition to evaluating recall information, teachers are encouraged to evaluate the other areas including process and product as indicated at the end of each instructional unit.

Every effort has been made to make this publication basic, readable and by all means usable. Three vital parts of instruction have been intentionally omitted from this publication: motivation, personalization and localization. These areas are left to the individual instructors and the instructors should capitalize on them. Only then will this publication really become a vital part of the teaching-learning process.

Ann Benson
Executive Director
Mid-America Vocational
Curriculum Consortium

FOREWORD

The Mid-America Vocational Curriculum Consortium is a group of states striving to develop needed curriculum materials. As member states, New Mexico, Colorado, Texas, Arkansas, Missouri, North Dakota, Nebraska, Kansas, South Dakota, Oklahoma, Arizona and Louisiana selected Snowmobile Repair as the third product of the consortium.

This publication is designed to provide instruction for occupational training in the area of snowmobile repair. It includes basic knowledge and skills in the areas of steering systems, drive belts and clutches, chain drives, axles, suspensions, brakes, tracks and shocks.

The purpose of this publication is to assist teachers in improving instruction in the area of snowmobile repair. As teachers use these materials, it is hoped that student performance will improve and that students will be better prepared to assume the role of repairing snowmobiles.

It is our belief that the teaching of Snowmobile Repair should become more effective with its use.

Amon Herd, Chairman
Board of Directors
Mid-America Vocational
Curriculum Consortium

ACKNOWLEDGMENTS

Appreciation is extended to those individuals who contributed their time and talents to the development of the Snowmobile Repair curriculum.

The contents of this publication were planned and reviewed by:

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USE OF THIS PUBLICATION

Instructional Units

The Snowmobile Repair curriculum includes eight areas. Each area consists of one or more units of instruction. Each instructional unit includes some or all of the basic components of a unit of instruction: performance objectives, suggested activities for teacher and students, information sheets, assignment sheets, job sheets, visual aids, tests and answers to the test. Units are planned for more than one lesson or class period of instruction.

Careful study of each instructional unit by the teacher will help him determine:

A. The amount of material that can be covered in each class period.

B. The skills which must be demonstrated.

   1. Supplies needed
   2. Equipment needed
   3. Amount of practice needed
   4. Amount of class time needed for demonstrations

C. Supplementary materials such as pamphlets and filmstrips that must be ordered.

D. Resource people that must be contacted.

Objectives

Each unit of instruction is based on performance objectives. These objectives state the goals of the course thus providing a sense of direction and accomplishment for the student.

Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction and specific objectives, stating the student performance necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which may have been used in this material:

Name	Identify	Describe
Label	Select	Define
List in writing	Mark	Discuss in writing
List orally	Point out	Discuss orally
Letter	Pick out	Interpret
Record	Choose	Tell how
Repeat	Locate	Tell what
Give		Explain

Order	Distinguish	Construct
Arrange	Discriminate	Draw
Sequence		Make
List in order		Build
Classify		Design
Divide		Formulate
Isolate		Reproduce
Sort		Transcribe
		Reduce
		Increase
		Figure

Demonstrate

Show your work
Show procedure
Perform an experiment
Perform the steps
Operate
Remove
Replace
Turn off/on
(Dis) assemble
(Dis) connect

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

The teacher should feel free to add objectives which will fit the material to the needs of his student and community. When a teacher adds objectives, he should remember to supply the needed information, assignment and/or job sheets and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. The activities are listed according to whether they are the responsibility of the instructor or the student.

Instructor: Duties of the instructor will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets and job sheets; preview filmstrips, make transparencies and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Students: Student activities are listed which will help the student to achieve the objectives for the unit.

Information Sheet

Information sheets provide content essential for meeting the cognitive (knowledge) objectives of the unit. The teacher will find that information sheets serve as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the unit objective.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to and in most situations should demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for a student to follow if he has missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this training.

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is the necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teacher should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

3/8" drive socket set
Combination wrench sets (Metric and Standard)
Screwdriver sets (Phillips and Standard)
Adjustable locking pliers
Side cutters
Mallet
Ball peen hammer
Punch set
Jack stand
Adjustable wrench set
Clutch puller set
Snap ring pliers
Needle nose pliers
Grinder (Bench or Floor Model)
Universal bearing puller
Vise
Bearing driver set
Pry bar set
Chisel set
Ignition wrench set
Propane torch

SKIS
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify all the parts of a typical ski assembly. The student should be able to remove, repair and replace all parts of a typical ski assembly. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical ski assembly to the correct definition.
2. Name two types of runner shoes used on a typical ski assembly.
3. Identify all main parts of a typical ski assembly when given a drawing illustrating the parts.
4. Describe when replacement of a runner shoe is necessary.
5. Distinguish between a mild steel runner shoe and a carbide runner shoe.
6. Demonstrate the ability to:
   a. Disassemble a typical ski assembly.
   b. Reassemble a typical ski assembly.

SKIS
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

A. Provide student with objective sheet

B. Provide student with information sheet

C. Make transparencies

D. Discuss unit and specific objectives

E. Discuss information sheet

F. Demonstrate procedures outlined on job sheets

G. Give test

II. Student

A. Read objectives

B. Read information sheet

C. Complete job sheets

D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

A. Objectives

B. Information sheet

C. Transparency masters

1. TM 1--Typical Ski Assembly

2. TM 2--Carbide Steel Runner Shoe

3. TM 3--Mild Steel Runner Shoe

D. Job sheets

1. Job Sheet #1--Disassembly of a Typical Ski Assembly

2. Job Sheet #2--Reassembly of a Typical Ski Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

SKIS
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Carbide runner shoe--Carbide steel inlaid in runner shoe, used to increase the life of the shoe and add to the snowmobile's handling ability

B. Main leaf spring--Use to connect the front of the ski to the back of the ski which supports the total weight of the snowmobile

C. Mild steel runner shoe--Mild steel rod which attaches to the ski, and aids in the snowmobile's handling ability, and eliminates wear to the ski

D. Rebound spring--Keeps the main leaf spring from bottoming out on very rough terrain

E. Ski--Steel runner curved at the tip and enables the snowmobile to glide over the snow without digging in

F. Ski retainer pins--Pins that connect the main leaf spring to the ski

G. Slider cushion--Main leaf spring slides back and forth on this brass or nylon plate to assure proper shock absorption

II. Types of runner shoes

A. Mild steel runner shoe

B. Carbide runner shoe

III. Main parts of a typical ski assembly (Transparency 1)

A. Carbide runner

B. Main leaf spring

C. Mild steel runner shoe

D. Auxiliary leaf spring

E. Overload leaf spring

INFORMATION SHEET

F. Spring coupler

G. Rebound leaf spring

H. Retainer pin

I. Spring slider cushion

IV. Replacement of runner shoes--Runner shoe replacement is necessary only if the shoe is worn to one half the thickness of the original rod

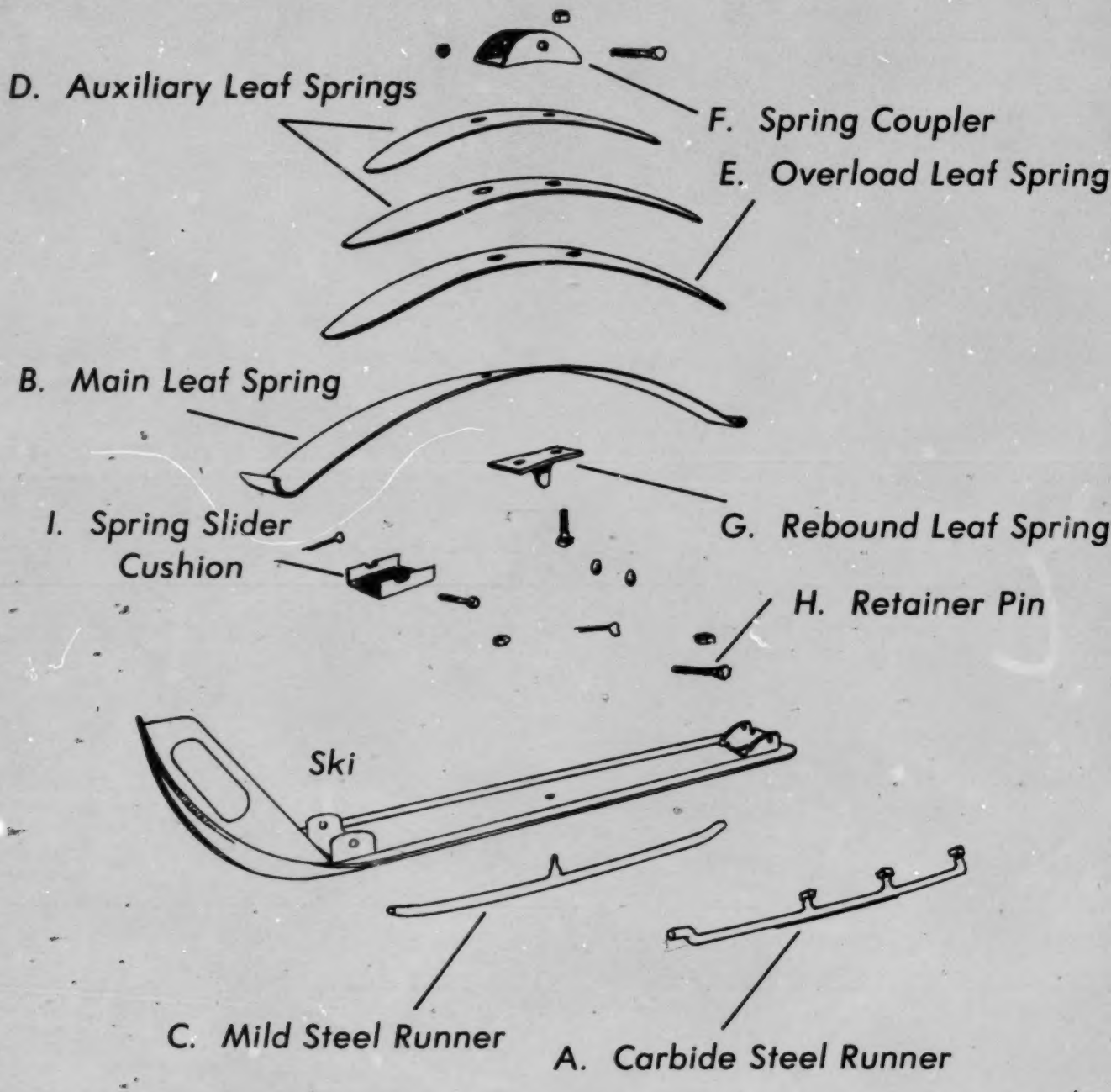
(NOTE: Carbide runner shoes very seldom need replacement because of the hardness of the steel and long wearing ability.)

V. Types of runner shoes

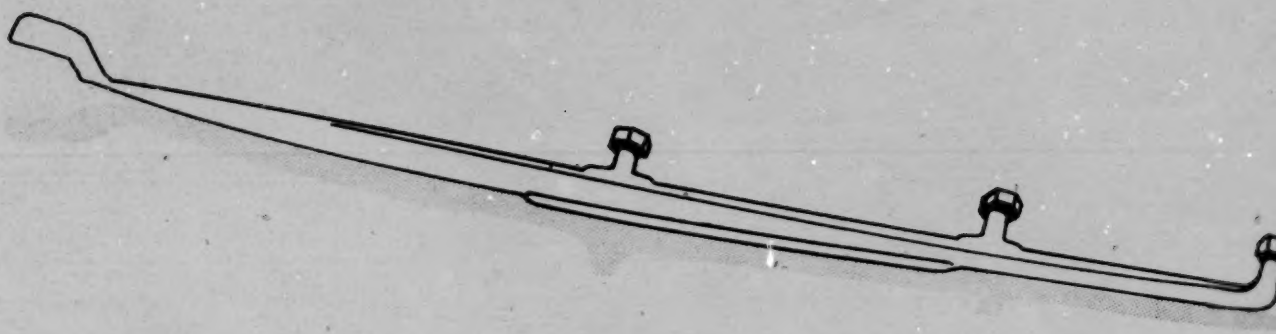
A. Carbide steel runner shoe (Transparency 2)

B. Mild steel runner shoe (Transparency 3)

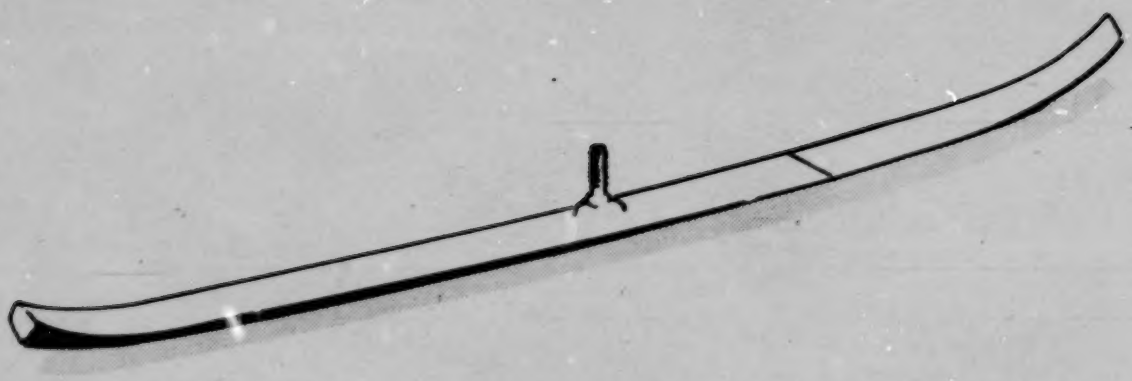
TYPICAL SKI ASSEMBLY



CARBIDE STEEL RUNNER SHOE



MILD STEEL RUNNER SHOE



SKIS
UNIT I

JOB SHEET #1--DISASSEMBLY OF A TYPICAL SKI ASSEMBLY

I. Tools and materials needed

A. Ski assembly on snowmobile

B. 3/8 inch drive socket set

C. Combination wrench set

D. Adjustable locking pliers

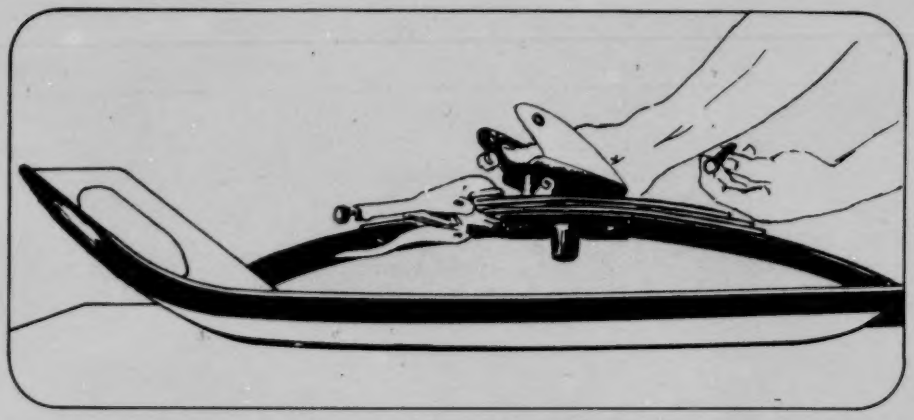
E. Side cutters

II. Procedure

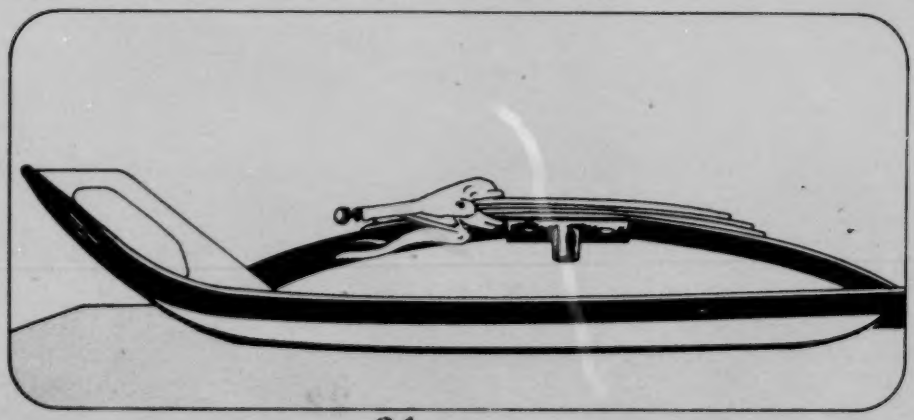
A. Tiit snowmobile on its side, opposite ski to be removed

B. Remove spring coupler lock nut

C. Remove spring coupler bolt



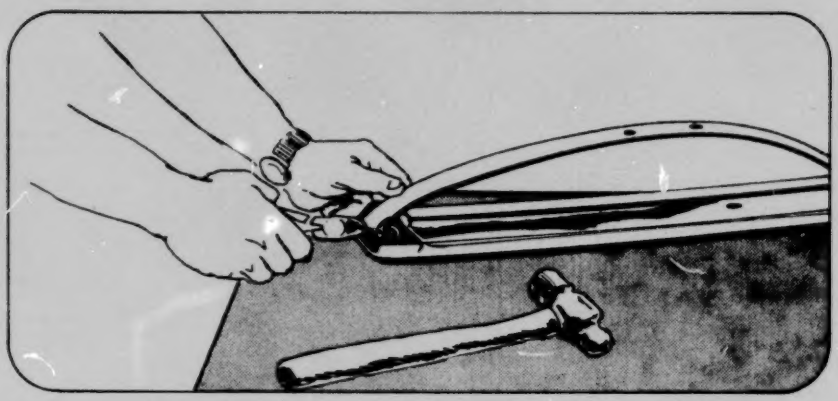
D. Using locking pliers to hold spring assembly, disassemble spring coupler from spring assembly



JOB SHEET #1

E. Remove locking pliers from spring assembly

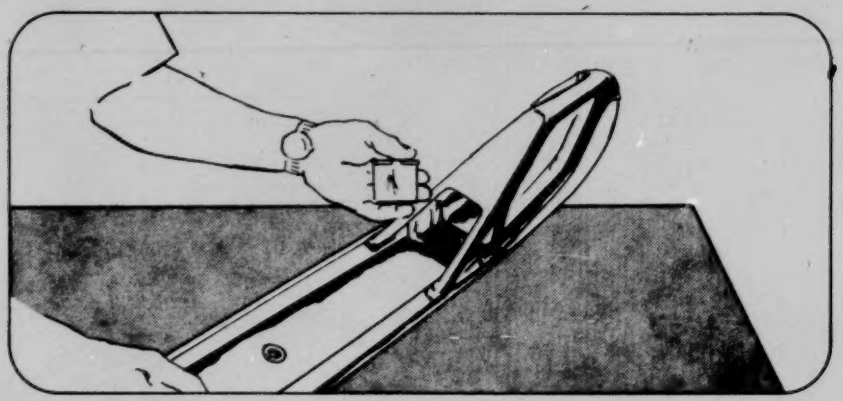
F. Remove cotter pins from both retainer pins



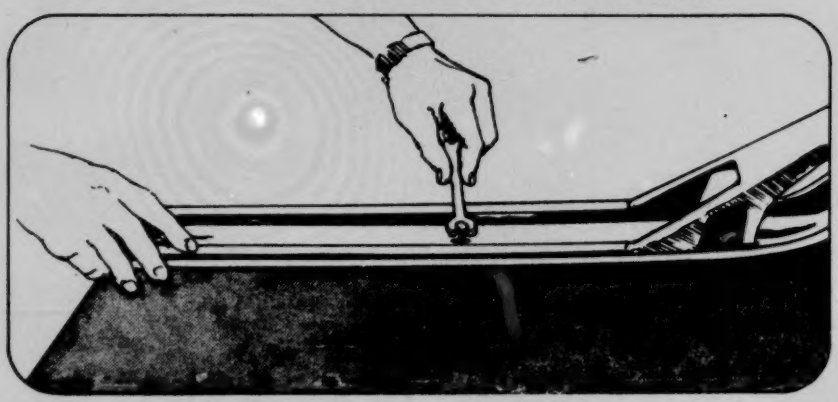
G. Remove retainer pins from ski

H. Lift off main leaf spring

I. Remove spring slider cushion



J. Remove runner shoe nut from runner shoe



JOB SHEET #1

K. Remove runner shoe from ski

L. Check runner shoe for wear

(NOTE: Replace if necessary.)

SKIS
UNIT I

JOB SHEET #2--REASSEMBLY OF A TYPICAL SKI ASSEMBLY

I. Tools and materials needed

A. Ski assembly

B. Snowmobile

C. Combination wrench set

D. 3/8 inch drive socket set

E. Adjustable locking pliers

F. Pin punch

G. Ball peen hammer

H. Two cotter pins (medium size and length)

II. Procedure

A. Reinstall runner shoe to ski

B. Install runner shoe nut

(NOTE: Tighten securely.)

C. Reinstall slider cushion

D. Install main leaf spring

E. Reinstall retainer pins on skis

F. Install new cotter pins

G. Place additional springs into position and lock in place with locking pliers

H. Reinstall spring coupler to springs

I. Reinstall ski assembly to ski leg on snowmobile

J. Install spring coupler bolt and nut

(NOTE: Tighten securely.)

SKIS
UNIT I

TEST

1. Match the terms on the right to the correct definition.

___ a.	Main leaf spring slides back and forth on this brass or nylon plate to assure proper shock absorption	1. Ski 2. Mild steel runner shoe 3. Rebound spring
___ b.	Carbide steel inlaid in runner shoe, used to increase the life of the shoe and add to the snowmobile's handling ability	4. Slider cushion 5. Carbide runner shoe 6. Ski retainer pins
___ c.	Pins that connect the main leaf spring to the ski	7. Main leaf spring
___ d.	Steel runner curved at the tip and enables the snowmobile to glide over the snow without digging in	
___ e.	Used to connect the front of the ski to the back of the ski which supports the total weight of the snowmobile	
___ f.	Mild steel rod which attaches to the ski, and aids in the snowmobile's handling ability, and eliminates wear to the ski	
___ g.	Keeps main leaf spring from bottoming out on very rough terrain	

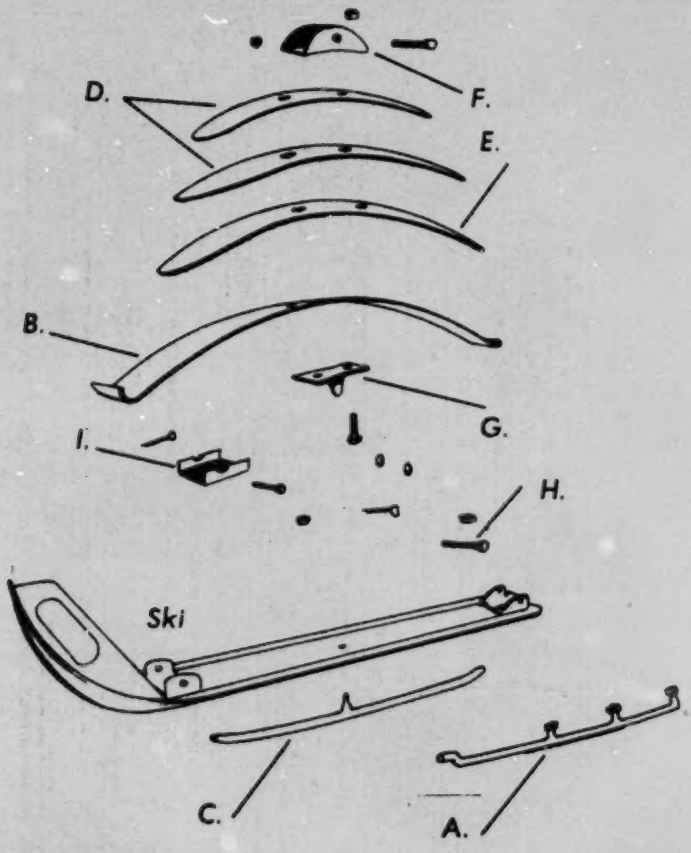
2. Name two types of runner shoes used on a typical ski assembly.

a.

b.

3. Identify all the main parts of a typical ski assembly.

TYPICAL SKI ASSEMBLY



a.

b.

c.

d.

e.

f.

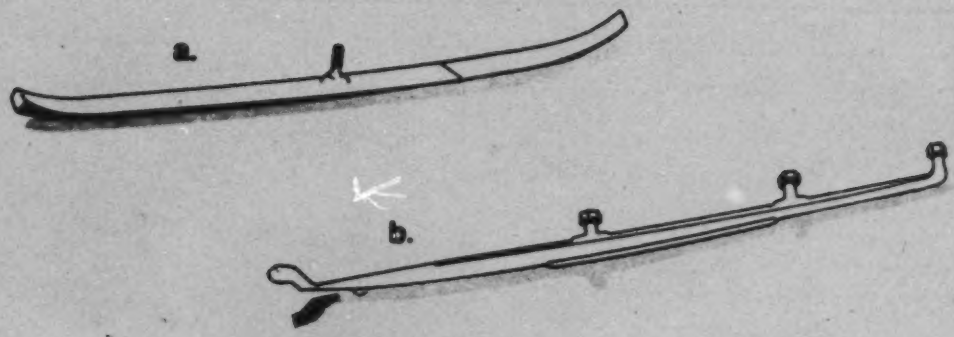
g.

h.

i.

4. Describe when replacement of a runner shoe is necessary.

5. Distinguish between a carbide runner shoe and a mild steel runner shoe.



a.

b.

6. Demonstrate the ability to:

   a. Disassemble a typical ski assembly.

   b. Reassemble a typical ski assembly.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SKIS
UNIT I

ANSWERS TO TEST

1. a. 4
   b. 5
   c. 6
   d. 1
   e. 7
   f. 2
   g. 3
2. a. Carbide runner shoe
   b. Mild steel runner shoe
3. a. Carbide runner
   b. Main leaf spring
   c. Mild steel runner shoe
   d. Auxiliary leaf spring
   e. Overload leaf spring
   f. Spring coupler
   g. Rebound leaf spring
   h. Retainer pin
   i. Spring slider cushion
4. Runner shoe replacement is necessary when the shoe is worn to one half the thickness of the original rod
5. a. Mild steel runner shoe
   b. Carbide steel runner shoe
6. Evaluated to the satisfaction of the instructor.

STEERING
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to make all the necessary adjustments and measurement of typical steering system on any given snowmobile. The student should be abie to remove and replace any damaged or worn parts. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical steering system.
2. Name two types of tie rod ends.
3. Describe when replacement of a ski leg bushing is necessary.
4. Describe the process for adjusting the toe-in on a typical steering system.
5. Identify all main parts of a typical steering system.
6. Demonstrate the ability to:
   a. Disassemble a typical steering system.
   b. Reassemble a typical steering system.

STEERING
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

A. Provide student with objective sheet

B. Provide student with information sheet

C. Make transparencies

D. Discuss unit and specific objectives

E. Discuss information sheet

F. Demonstrate procedures outlined on job sheets

G. Give test

II. Student

A. Read objective sheet

B. Read information sheet

C. Complete job sheets

D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit:

A. Objectives

B. Information sheet

C. Transparency masters

1. TM 1--Main Parts of a Typical Steering System

2. TM 2A--Ball Joint Tie Rod End

3. TM 2B--L-Shaped Tie Rod End

D. Job sheets

1. Job Sheet #1--Disassembly of a Typical Steering System

2. Job Sheet #2--Reassembly of a Typical Steering System

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

STEERING
UNIT II

INFORMATION SHEET

I. Terms and definitions (Transparency 1)

A. Grip--Plastic or rubber handle which attaches to the handle bars to eliminate slippage of hand off the handle bars

B. Hand handle--Small lever device used to control the throttle and brake cables

C. Handle bars--Used to steer the snowmobile; rotation of the handle bars causes a pull-push action

D. Ski leg--Connects the ski to the steering arm

(NOTE: This is also called the spindle.)

E. Ski leg bushing--Plastic or soft metal bushing inserted into the frame where the ski leg enters to eliminate friction

F. Steering arm--Connects to the tie rod and acts as a lever to give the push-pull action of the ski

G. Steering bushing--Bushing usually made of rubber or soft metal in which the steering column enters to eliminate friction and absorb shock

H. Steering column--Steel bar or shaft which connects to the handle bar and tie rod ends used in steering

I. Tie rod--Used to connect the tie rod ends from the steering column to steering arm and is adjustable to correct toe-in

J. Tie rod end--Attaches to the steering arm and steering column and is threaded for necessary adjustments

K. Toe-in--Difference in distance between the width of the skis at the front and the back

L. Upper column--Brace or bar mounted on the frame or engine to support the steering column

INFORMATION SHEET

II. Types of tie rod ends

A. Ball joint tie rod end (Transparency 2A)

B. L-shaped tie rod end (Transparency 2B)

III. Replacement of a ski leg bushing

A. If the bushing shows wear

B. If the ski leg can be shifted back and forth within the frame

IV. Adjusting toe-in

A. Adjust the tie rods to the correct specifications

B. Toe-in adjustments will vary on most machines

C. Specifications for each machine should be looked up

V. Main parts of a typical steering system (Transparency 1)

A. Grip

B. Hand handle

C. Handle bars

D. Ski leg

E. Ski leg bushing

F. Steering arm

G. Steering bushing

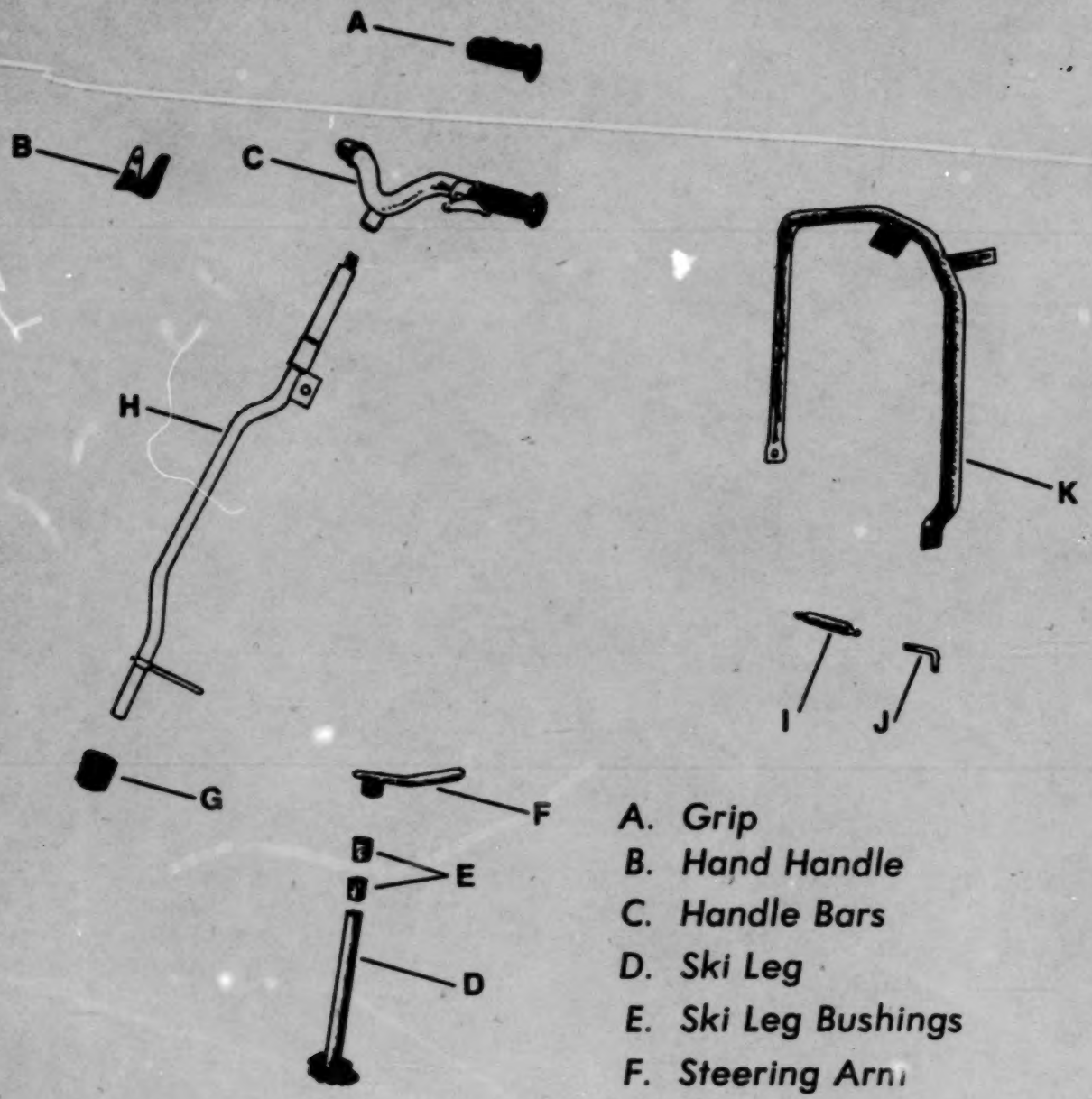
H. Steering column

I. Tie rod

J. Tie rod end

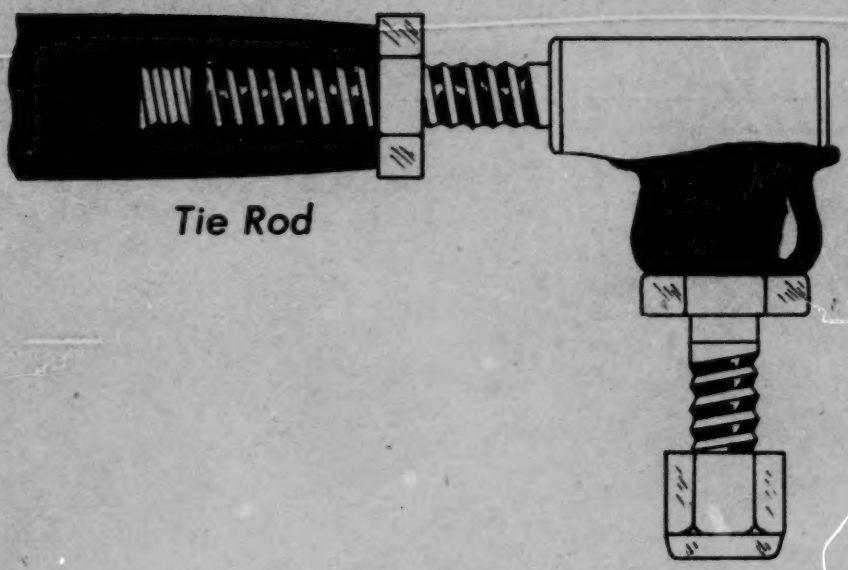
K. Upper column

MAIN PARTS OF A TYPICAL STEERING SYSTEM



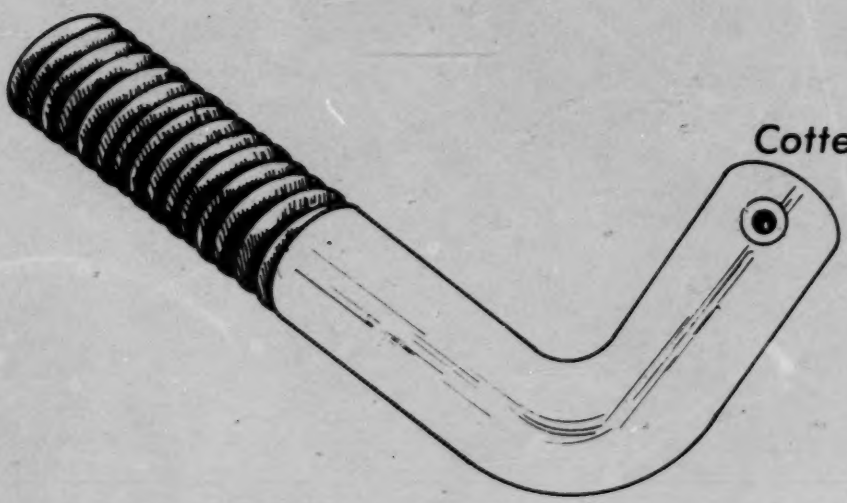
A. Grip
B. Hand Handle
C. Handle Bars
D. Ski Leg
E. Ski Leg Bushings
F. Steering Arm
G. Steering Bushing
H. Steering Column
I. Tie Rod
J. Tie Rod End
K. Upper Column

BALL JOINT TIE ROD END



TM - 2A

L - SHAPED TIE ROD END



TM - 2B

STEERING
UNIT II

JOB SHEET #1--DISASSEMBLY OF A TYPICAL STEERING SYSTEM

I. Tools and materials needed

A. Snowmobile

B. 3/8 drive socket set

C. Combination wrench set

D. Standard screwdriver

E. Soft mallet

F. Ball peen hammer

G. Punch set

H. Jack stand

I. Container for holding parts

J. Adjustable wrench

II. Procedure

A. Raise and support front end of snowmobile with jack stand, so that the skis are off the floor

B. Remove skis from ski leg

(NOTE: Disconnect coupler.)

C. Remove throttle and brake cable housings from handle bars

D. Remove handle bars

(NOTE: Use soft mallet to drive handle bars off of steering columns if applicable.)

E. Remove tie rod ends from steering column by removing cotter pins or nuts

F. Remove upper column or steering column support from frame or engine

G. Remove steering column from frame

JOB SHEET #1

H. Disconnect outside tie rod ends connected to steering arm

I. Loosen steering arm bolts about 3 to 4 revolutions, drive bolt into ski leg by hitting bolt with hammer to loosen leg from steering arm

J. Remove ski leg by pulling it out of the frame

K. Check ski leg bushings for wear

L. Check tie rod ends for any possible damage

(NOTE: Replace if necessary.)

M. Clean all parts for reassembly

STEERING
UNIT II

JOB SHEET #2--REASSEMBLY OF A TYPICAL STEERING SYSTEM

I. Tools and materials needed

A. Snowmobile

B. 3/8 drive socket set

C. Combination wrench set

D. Standard screwdriver

E. Soft mallet

F. Ball peen hammer

G. Punch set

H. Jack stand

I. Adjustable wrench

II. Procedure

A. Check tie rod ends for any possible damage

(NOTE: Replace if necessary.)

B. Check ski leg bushings for wear

(NOTE: Replace if necessary.)

C. Reinstall ski leg by pushing it into the frame

D. Install steering arm and steering arm bolt leaving bolt loose

(NOTE: This is so that toe in can be adjusted at a later time.)

E. Connect tie rod ends to steering arm

F. Reinstall steering column to frame

G. Reinstall upper column or steering column support to frame or engine

(NOTE: Select the one which is applicable.)

H. Reinstall tie rod ends to steering column

(NOTE: Install new cotter pins if applicable.)

I. Install handle bars in alignment with skis

J. Reinstall throttle and brake cable housings to handle bars

K. Reinstall skis to ski leg

L. Adjust toe-in on skis

M. Tighten steering arm bolts

N. Remove jack stand from snowmobile

O. Check operation of steering system

TEST

1. Match the terms on the right to the correct definition.

___ a. Difference in distance between the ski at the front and the back

___ b. Plastic or rubber handle which attaches to the handle bars to eliminate slippage of the hands off the handle bars

___ c. Used to steer the snowmobile; rotation of the handle bars causes a pull-push action

___ d. Connects the ski to the steering arm

___ e. Connects the tie rod end and acts as a lever to give the push-pull action of the ski

___ f. Bushing usually made of rubber or soft metal in which the steering column enters to eliminate friction and absorb shock

___ g. Plastic or soft metal bushing inserted into the frame where the ski leg enters to eliminate friction

___ h. Brace or bar mounted on the frame or engine to support the steering column

___ i. Steel bar or shaft which connects to handle bar and tie rod ends used in steering

___ j. Small lever device used to control the throttle and brake cables

___ k. Attaches to the steering arm and steering column and is threaded for necessary adjustments

___ l. Used to connect the tie rod ends from the steering column to steering arm and is adjustable to correct toe-in

1. Ski leg bushing
2. Hand handle
3. Steering column
4. Tie rod end
5. Steering arm
6. Toe-in
7. Handle bars
8. Steering bushing
9. Tie rod
10. Upper column
11. Grip
12. Ski leg

2. Name two types of tie rod ends.

   a.

   b.

3. Describe when replacement of a ski leg bushing is necessary.

4. Describe the process for adjusting toe-in on a typical steering system.

5. Identify all main parts of a typical steering system.

   a.

   b.

   c.

   d.

   e.

   f.

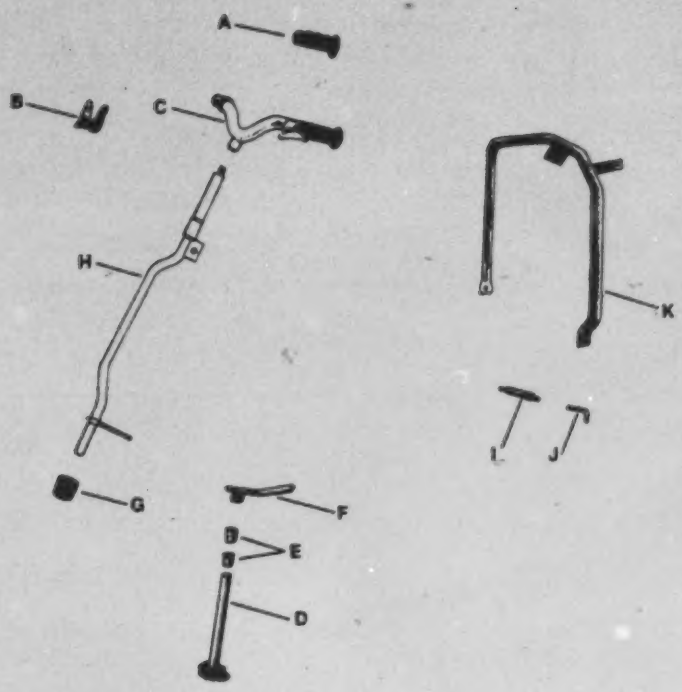
   g.

   h.

   i.

   j.

   k.



6. Demonstrate the ability to:

   a. Disassemble a typical steering system.

   b. Reassemble a typical steering system.

   (NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

STEERING
UNIT II

ANSWERS TO TEST

1. a. 6
   b. 11
   c. 7
   d. 12
   e. 5
   f. 8
   g. 1
   h. 10
   i. 3
   j. 2
   k. 4
   l. 9
2. a. Ball joint tie rod end
   b. L-shaped tie rod end
3. Replacement is necessary only if the bushing shows wear or if the ski leg can be shifted back and forth within the frame.
4. Toe-in is adjusted by adjusting the tie rods to the correct specifications.
5. a. Grip
   b. Hand handle
   c. Handle bars
   d. Ski leg
   e. Ski leg bushing
   f. Steering arm

5. g. Steering bushing
   h. Steering column
   i. Tie rod
   j. Tie rod end
   k. Upper column
6. Evaluated to the satisfaction of the instructor.

ENGINE CLUTCHES
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify all the parts of a clutch assembly. The student should be able to remove, repair and check the operation of a typical clutch assembly. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical clutch assembly to the correct definition.
2. Identify all the basic parts of a typical clutch assembly when given a drawing illustrating the parts.
3. Describe when lubrication of different types of clutches would be necessary.
4. Select from two illustrations the clutch assembly which has timing marks to assure proper balance, lubrication and reassembly.
5. Distinguish between a threaded shaft clutch and a tapered shaft clutch when given an illustration.
6. Demonstrate the ability to:
   a. Disassemble a typical clutch assembly.
   b. Reassemble a typical clutch assembly.

ENGINE CLUTCHES
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in the job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1--Basic Parts of a Typical Clutch Assembly
  2. TM 2--Clutch Timing Marks
  3. TM 3--Threaded Shaft Clutch
  4. TM 4--Tapered Shaft Clutch

D. Job sheets

1. Job Sheet #1--Disassembly of a Typical Clutch Assembly

2. Job Sheet #2--Reassembly of a Typical Clutch Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

ENGINE CLUTCHES
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Clutch--An assembly which applies pressure to the drive belt in order to transfer power from the engine to the track

B. Centrifugal weights--Usually mounted to the outer half and forces the sliding half toward the inner half to cause pressure on the drive belt

C. Inner half--Portion of the clutch which is attached to the engine and is stationary which receives the sliding half and is either threaded or tapered to be attached to the engine

D. Sliding half--Portion of the clutch which is forced inward by the centrifugal weights and forces the drive belt against the inner half transferring power to the driven pulley

E. Clutch spring--Causes pressure against the sliding half and is used to control the engagement speed at different R.P.M.'s

F. Rollers--Usually made of nylon and used to engage the sliding pulley which is moved by centrifugal force the same as weights

G. Shim--Used behind the inner half to control adjustment and off set of the clutch assembly

H. Lubrication plate--Oil impregnated brass plates used on square shaft clutches to lubricate the sliding half

I. Timing marks--Usually located on all three clutch halves and should be realigned upon reassembly to assure proper lubrication, operation and balance

II. Basic parts of a typical clutch assembly (Transparency 1)

A. Inner half

B. Outer half

C. Sliding half

D. Spring

E. Shim

F. Bearing

G. Weights (Centrifugal)

H. Rollers (Centrifugal)

III. Lubrication

A. Necessary only when recommended by the manufacturer

IV. Timing marks (Transparency 2)

V. Types of clutches

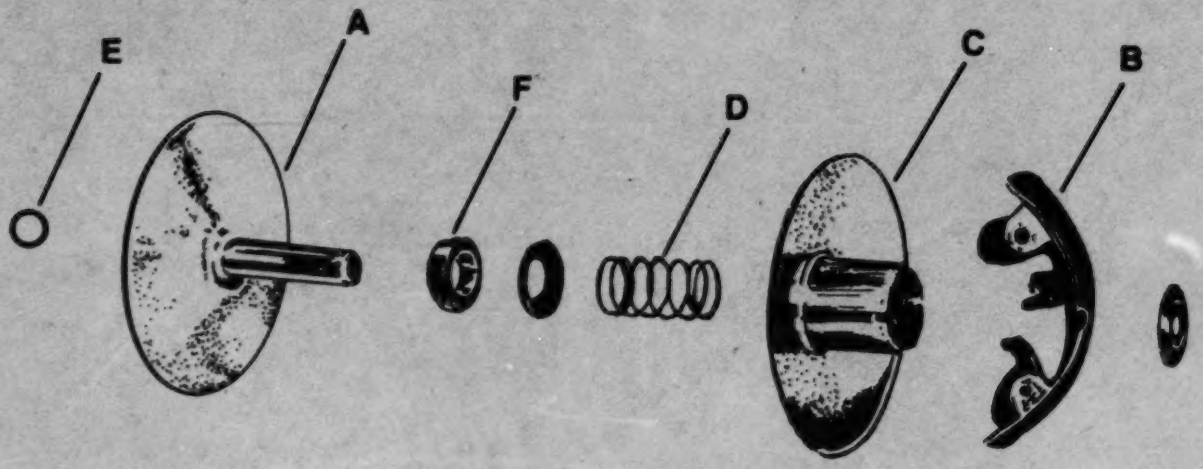
A. Threaded shaft clutch--Attaches the engine by threading (Transparency 3)

B. Tapered shaft clutch

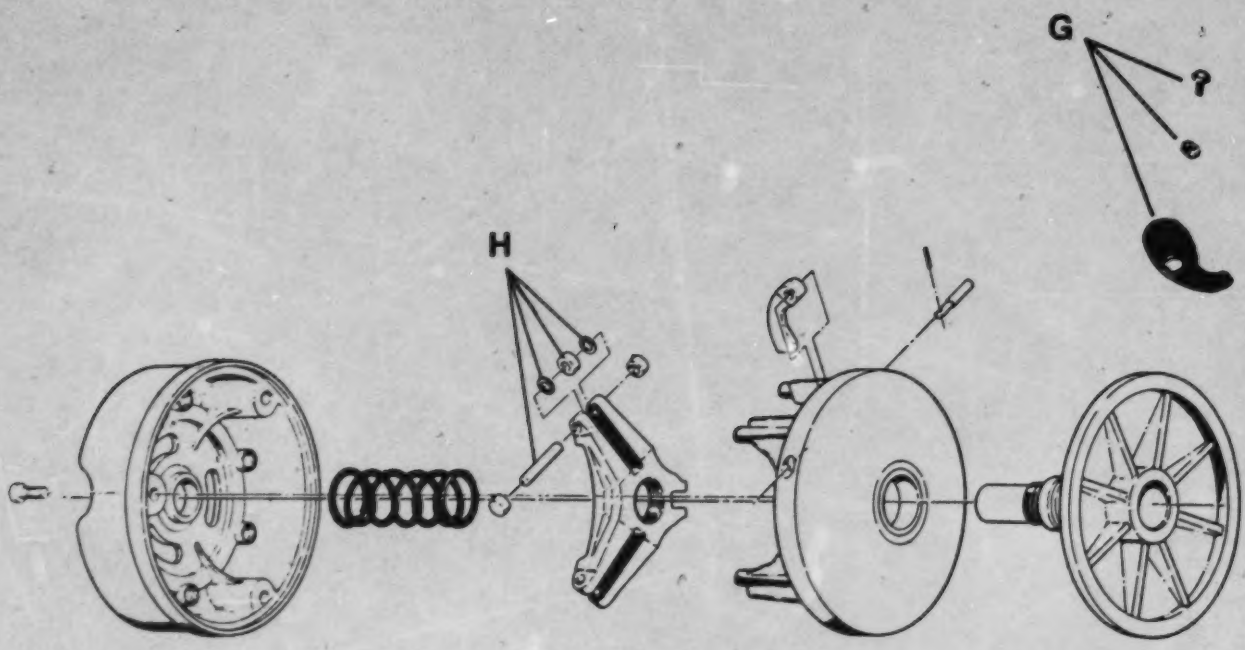
1. Has an inside taper which attaches to the tapered crankshaft on the engine

2. Secured by a bolt reaching entirely through the clutch assembly (Transparency 4)

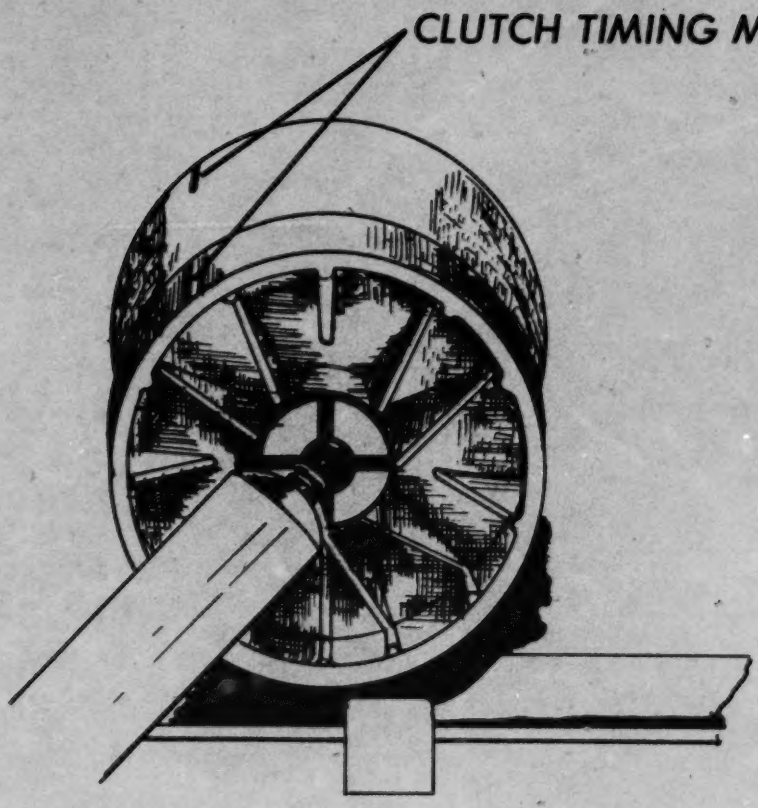
BASIC PARTS OF A TYPICAL CLUTCH ASSEMBLY



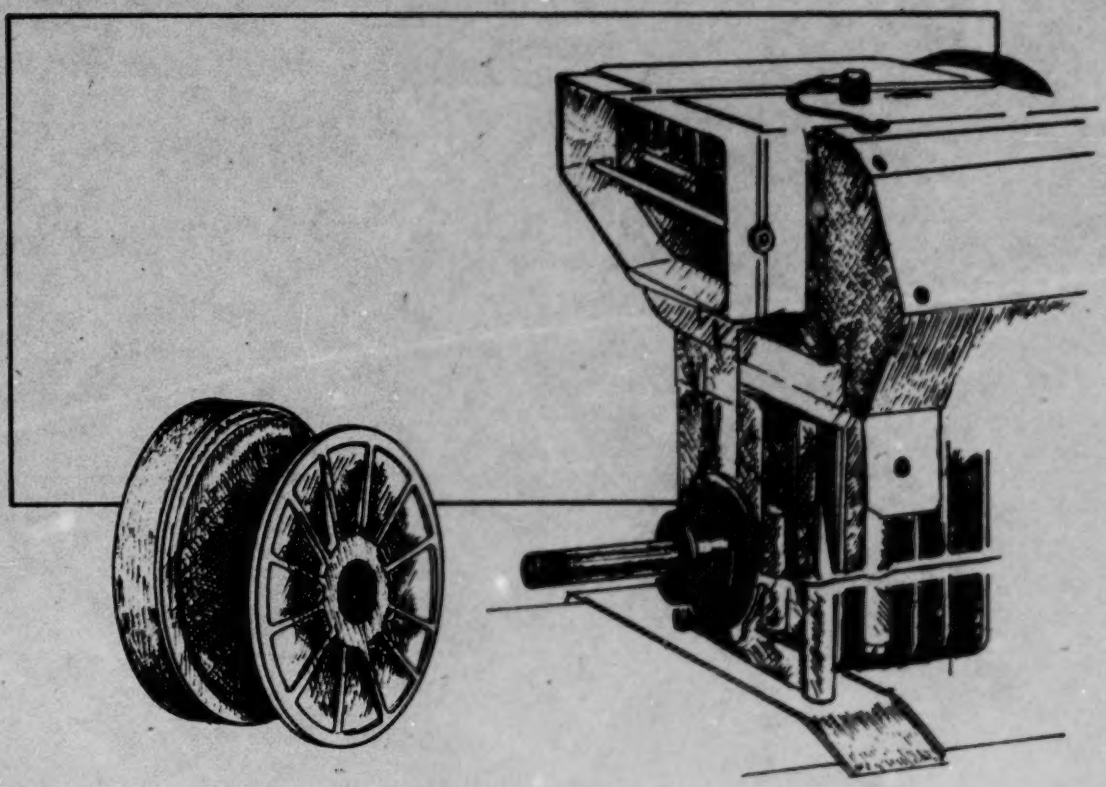
CLUTCH ASSEMBLY USING CENTRIFUGAL WEIGHTS



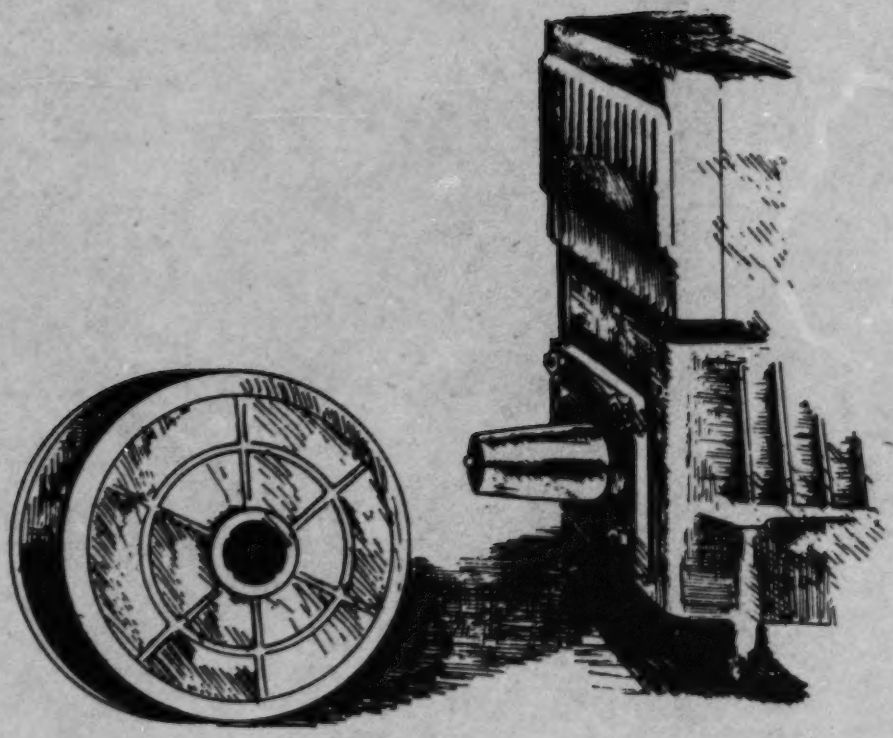
CLUTCH ASSEMBLY USING ROLLERS



CLUTCH TIMING MARKS



THREADED SHAFT CLUTCH



TAPERED SHAFT CLUTCH

ENGINE CLUTCHES
UNIT I

JOB SHEET #1--DISASSEMBLY OF A TYPICAL CLUTCH ASSEMBLY

I. Tools and materials needed

A. Combination wrench set

B. Special puller (if applicable)

C. Snowmobile engine with clutch

D. Mallet

E. Medium size phillips screwdriver

F. Medium size standard screwdriver

II. Procedure

A. Remove spark plug wires from spark plugs

B. Remove any clutch guards that are on snowmobile

C. Determine if special puller is necessary

D. Loosen bolt connecting clutch assembly to engine

(NOTE: This is applicable only to some models.)

E. Remove clutch assembly from engine using puller if necessary

F. Disassemble outer half from sliding half

G. Remove outer half and sliding half from inner half

H. Inspect all counter weights and rollers for damage

I. Clean and lube all parts for reassembly (if applicable)

JOB SHEET #2--REASSEMBLY OF A TYPICAL CLUTCH ASSEMBLY

I. Tools and materials needed

A. Combination wrench set

B. Snowmobile or snowmobile engine and clutch

C. Mallet

D. Medium size phillips screwdriver

E. Medium size standard screwdriver

F. Oil can or clutch grease (if applicable)

II. Procedure

A. Lubricate all counter weights and/or rollers before reassembly (if applicable)

B. Reinstall sliding half onto the inner half

C. Note position of timing marks on clutch halves so that they are aligned properly (if applicable)

D. Install outer clutch half

E. Install clutch assembly onto engine

F. Install clutch bolt and torque to the proper specifications

G. Check the operation

ENGINE CLUTCHES
UNIT I

TEST

1. Match terms on the right to the correct definition.

___ a. An assembly which applies pressure to the drive belt in order to transfer power from the engine to the track

___ b. Usually mounted to the outer half and forces the sliding half toward the inner half to cause pressure on the drive belt

___ c. Portion of the clutch which is attached to the engine and is stationary which receives the sliding half and is either threaded or tapered to be attached to the engine

___ d. Portion of the clutch which is forced inward by the centrifugal weights and forces the drive belt against the inner half transferring power to the drive pulley

___ e. Causes pressure against the sliding half and is used to control the engagement speed at different R.P.M.'s

___ f. Usually made of nylon and used to engage the sliding pulley which is moved by centrifugal force the same as weights

___ g. Used behind the inner half to control adjustment and off set of the clutch assembly

___ h. Oil impregnated brass plates used on square shaft clutches to lubricate the sliding half

___ i. Usually located on all three clutch halves and should be realigned upon reassembly to assure proper lubrication, operation and balance

1. Sliding half
2. Shim
3. Inner half
4. Rollers
5. Timing marks
6. Clutch spring
7. Lubrication plate
8. Clutch
9. Centrifugal weights

2. Identify all the basic parts of a clutch assembly.

   a.

   b.

   c.

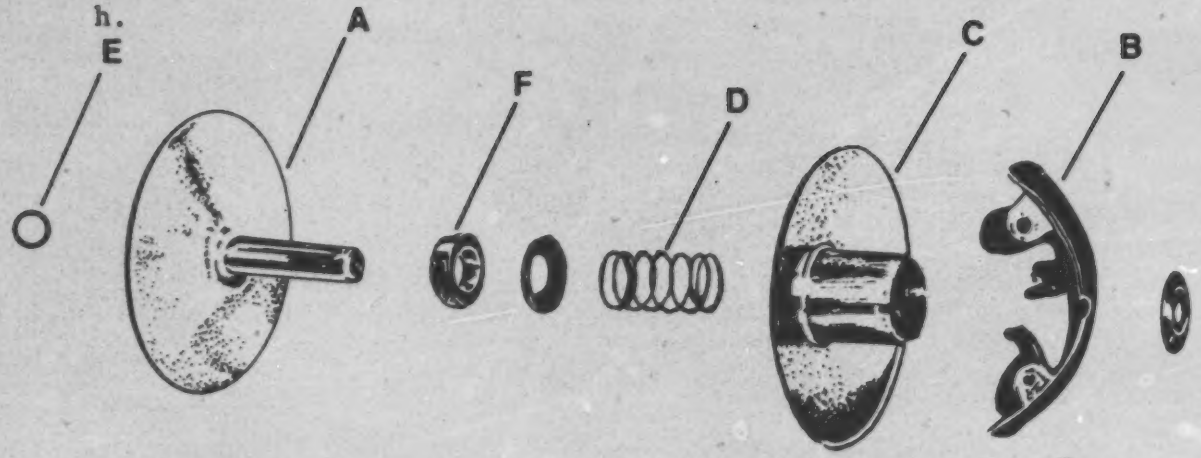
   d.

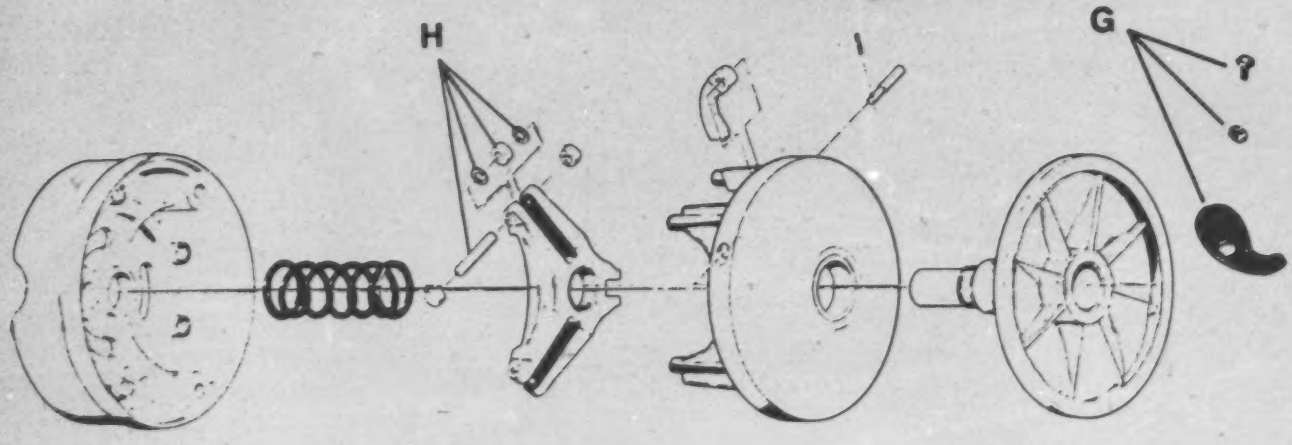
   e.

   f.

   g.

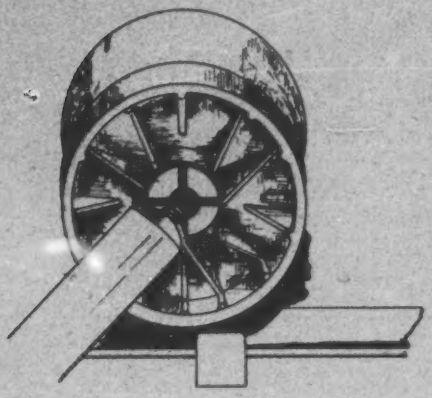
   h.



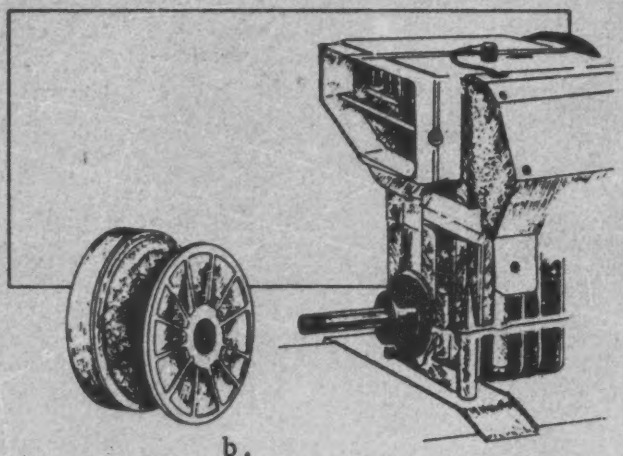


3. Describe when lubrication of different clutches would be necessary.

4. Select the clutch assembly which has timing marks by placing an "X" below the illustration.

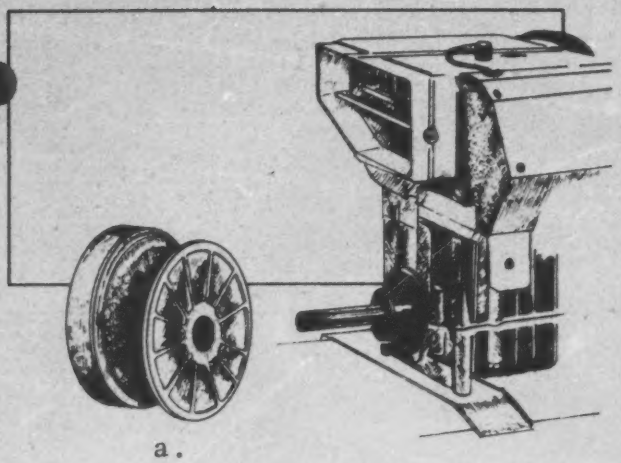


___ a.

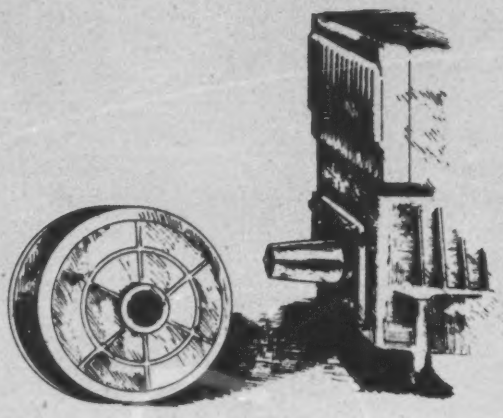


___ b.

5. Distinguish between a threaded shaft clutch and a tapered shaft clutch by labeling the following illustrations.



a.



b.

6. Demonstrate the ability to:

   a. Disassemble a typical clutch assembly.

   b. Reassemble a typical clutch assembly.

   (NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

ENGINE CLUTCHES
UNIT I

ANSWERS TO TEST

1. a. 8
   b. 9
   c. 3
   d. 1
   e. 6
   f. 4
   g. 2
   h. 5
   i. 7
2. a. Inner half
   b. Outer half
   c. Sliding half
   d. Spring
   e. Shim
   f. Bearing
   g. Weights
   h. Rollers
3. Lubrication is necessary only when recommended by the manufacturer.
4. a
5. a. Tapered shaft clutch
   b. Threaded shaft clutch
6. Evaluated to the satisfaction of the instructor

DRIVE BELTS
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify causes of drive belt failure. The student should be able to remove and replace any drive belt on any snowmobile. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a drive belt to the correct definition.
2. Identify nine types of belt failure when given a drawing illustrating drive belts damage.
3. Match terms identifying belt failures with the causes of belt failures.
4. Describe when replacement of a drive belt is necessary.
5. Demonstrate the ability to:
   a. Remove a drive belt from any given snowmobile.
   b. Replace a drive belt on any given snowmobile.

DRIVE BELTS
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

A. Provide students with objective sheet

B. Provide students with information and job sheets

C. Make transparencies

D. Discuss unit and specific objectives

E. Discuss information and job sheets

F. Provide student with an example of different types of belt failure by taking a field trip to different repair shops

G. Give test

II. Student

A. Read objectives

B. Study information and job sheets

C. Perform according to the type of performance called for by each specific objective

D. Provide the instructor with one example of a drive belt that has failed

E. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

A. Objectives

B. Information sheet

C. Transparency masters

1. TM 1--Belt Flip-Over at High Speed
2. TM 2--Sheared Cogs
3. TM 3--Cracks Between Cogs
4. TM 4--Edge Cord Breakage
5. TM 5--Disintegration
6. TM 6--Belt Worn Narrow in One Section
7. TM 7--Excessive Wear on Top Edge
8. TM 8--Excessive Glaze or Baking on Sides
9. TM 9--Uneven Belt Wear on One Side of Belt
10. TM 10--Failures and Causes of Belt Damage

D. Job Sheet #1--Removal and Replacement of a Drive Belt

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

DRIVE BELTS
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Drive belt--Rubber belt used to transfer the power from the engine to the track

B. Belt disintegration--Drive belt flies to pieces while snowmobile is in action

C. Cords--Heavy reinforcement material molded into the drive belt for longer belt wear and strength

D. Cogs--Used to eliminate slippage of the belt on pulley halves and add to the belt's flexibility

E. Belt ride out--Belt overriding pulleys which is caused by pulleys being too close together or drive belt too long

F. Pulley distance--Distance between engine clutch and driven pulley assembly

II. Types of belt failure (Transparencies 1-9)

A. Flip over at high speeds

B. Sheared cogs

C. Cracks between cogs

D. Edge cord breakage

E. Disintegration

F. Worn narrow in one section

G. Excessive wear on top edge

H. Excessive glaze or baking on sides

I. Uneven belt wear on one side of belt

III. Failure and causes of belt damage (Transparency 10)

A. Belt flip over

1. Improper pulley alignment

2. Excessive belt speed

B. Sheared cogs--Belt rubbing stationary objects on pulleys

C. Cracks between cogs--Belt wearing out

D. Edge cord breakage--Improper pulley alignment

E. Belt disintegration--Excessive belt speed

F. Belt worn narrow only in one spot

1. Improper pulley distance

2. Track frozen

3. Engine clutch not working properly

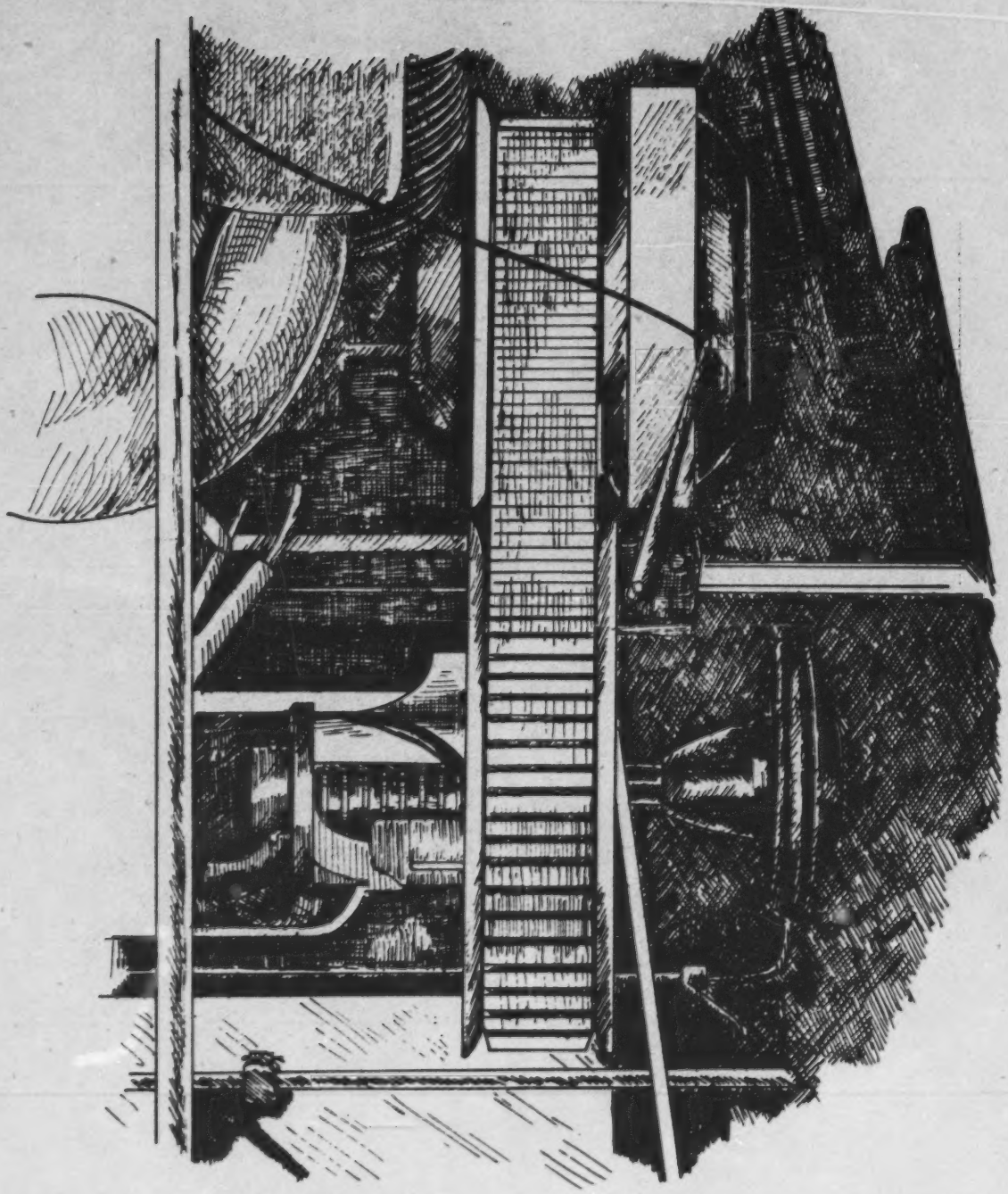
G. Excessive wear only on top edge--Rough pulley surfaces

H. Excessive glaze or baking of sides--Improper pulley alignment

IV. Replacement of a drive belt--Necessary when any of the nine types of failures occur

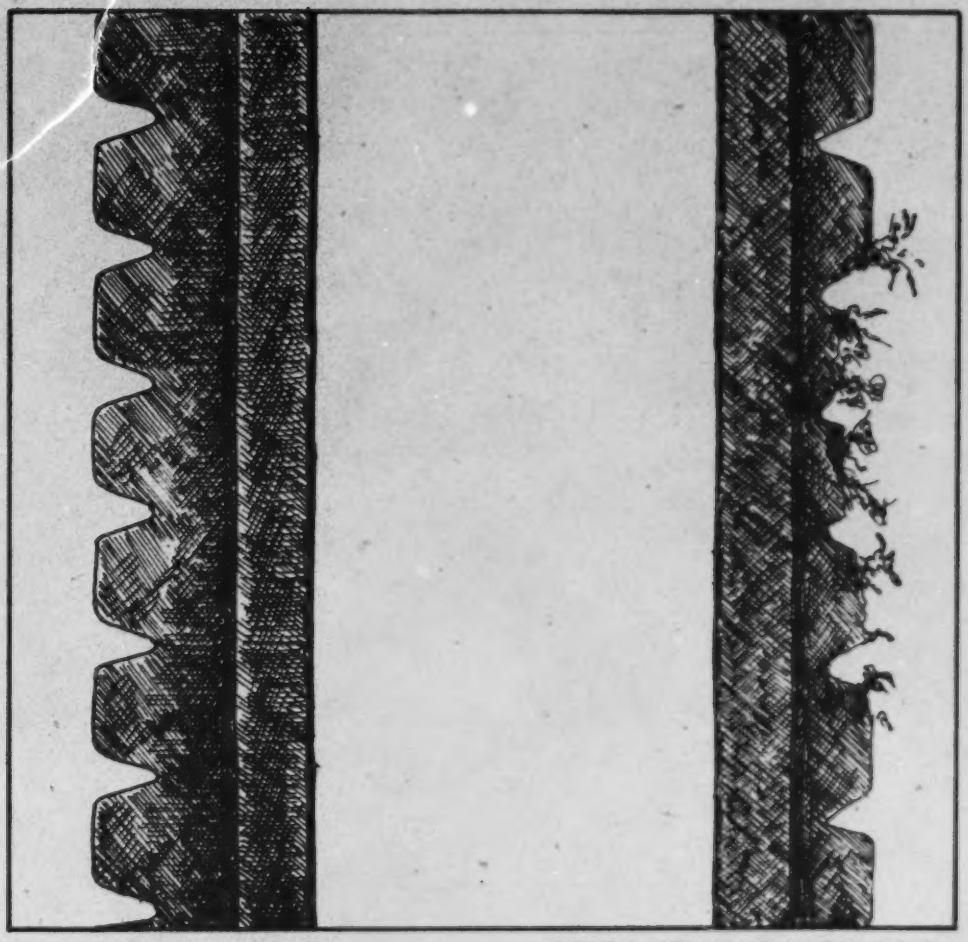
BELT FAILURE

BELT FLIP-OVER AT HIGH SPEED



BELT FAILURE

SHEARED COGS

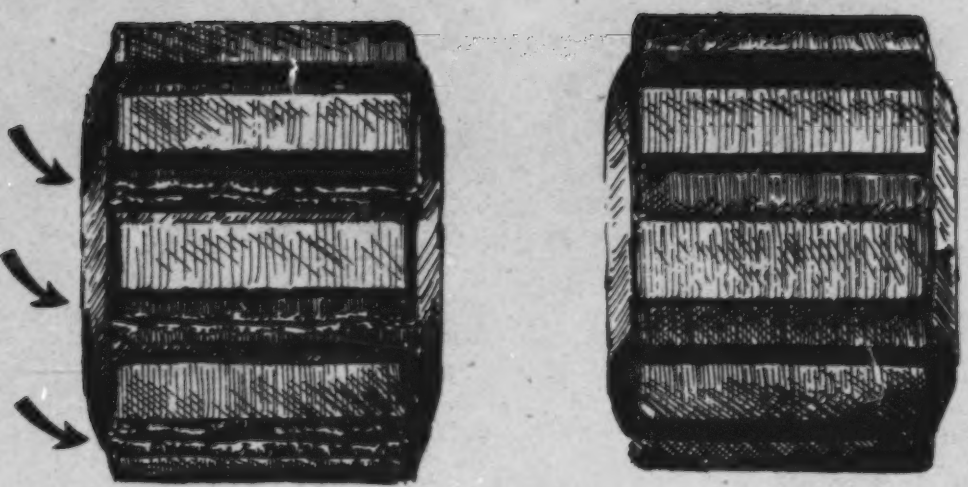


NORMAL BELT

BELT WITH SHEARED COGS

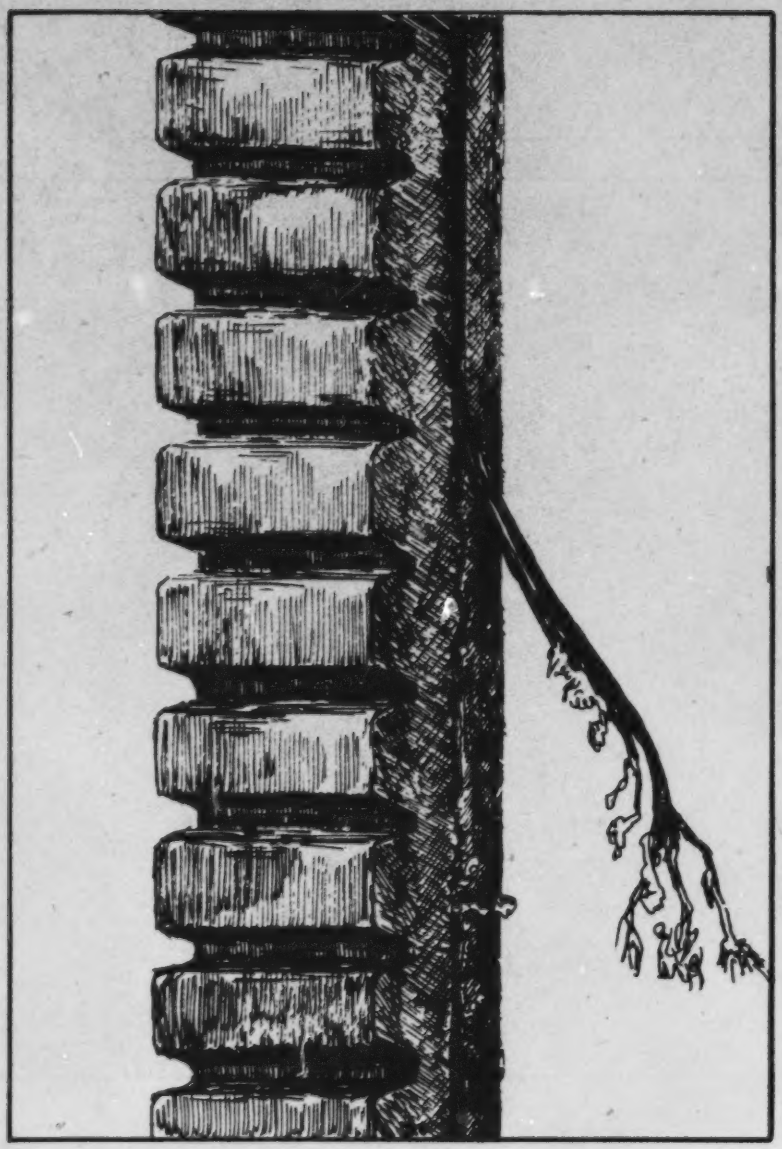
BELT FAILURE

CRACKS BETWEEN COGS

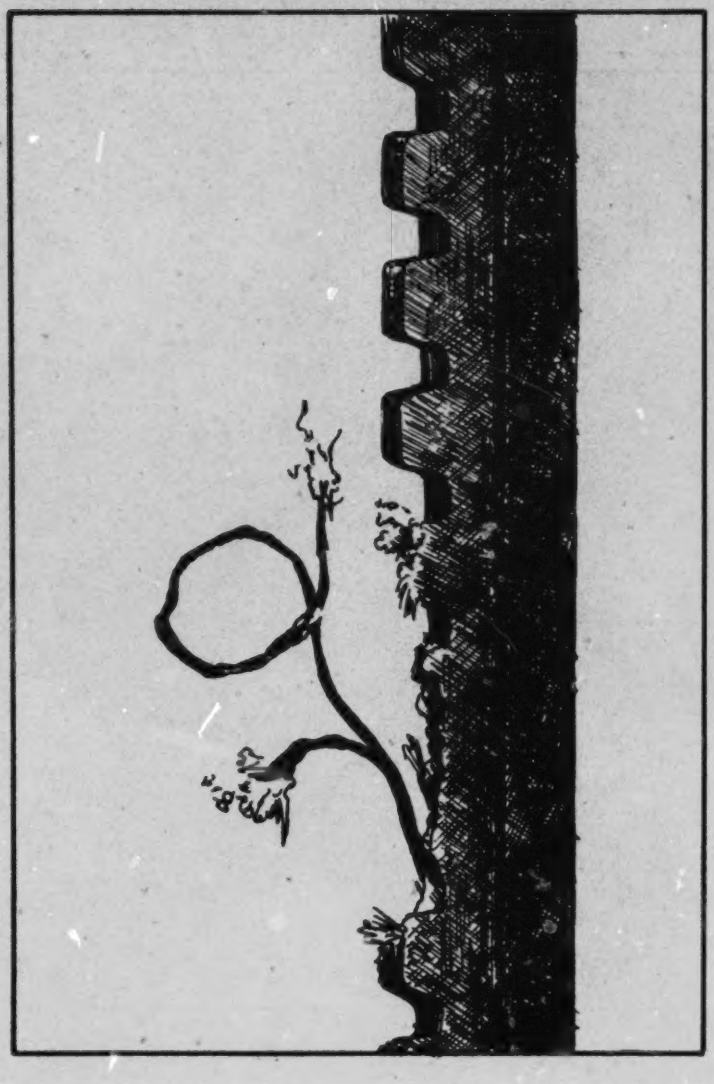


BELT FAILURE

EDGE CORD BREAKAGE

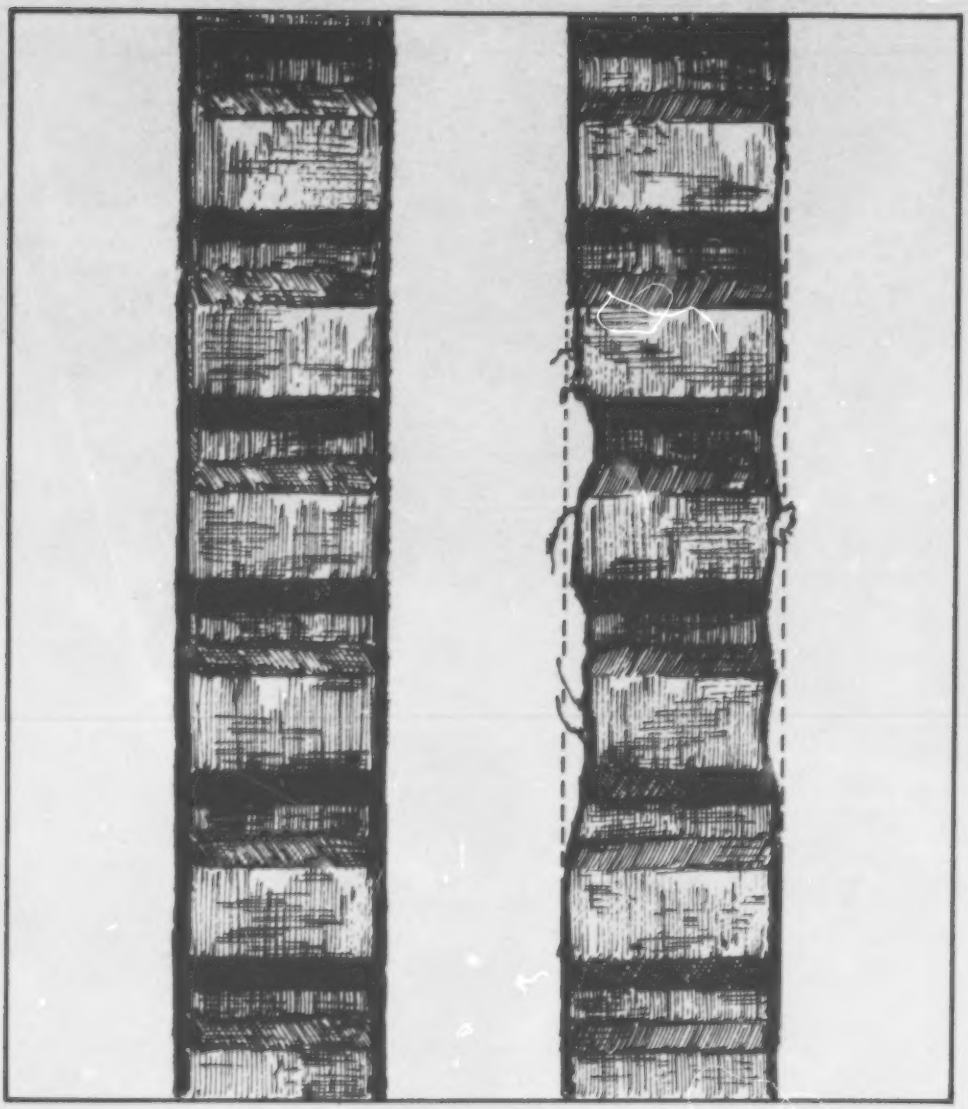


BELT FAILURE
DISINTEGRATION



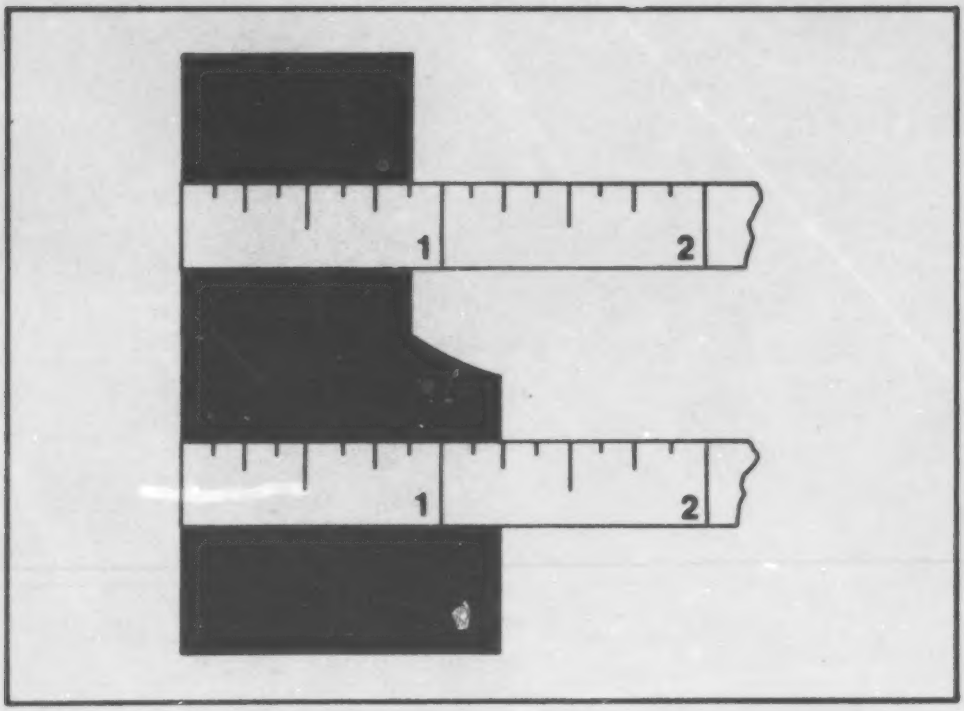
BELT FAILURE

BELT WORN NARROW IN ONE SECTION



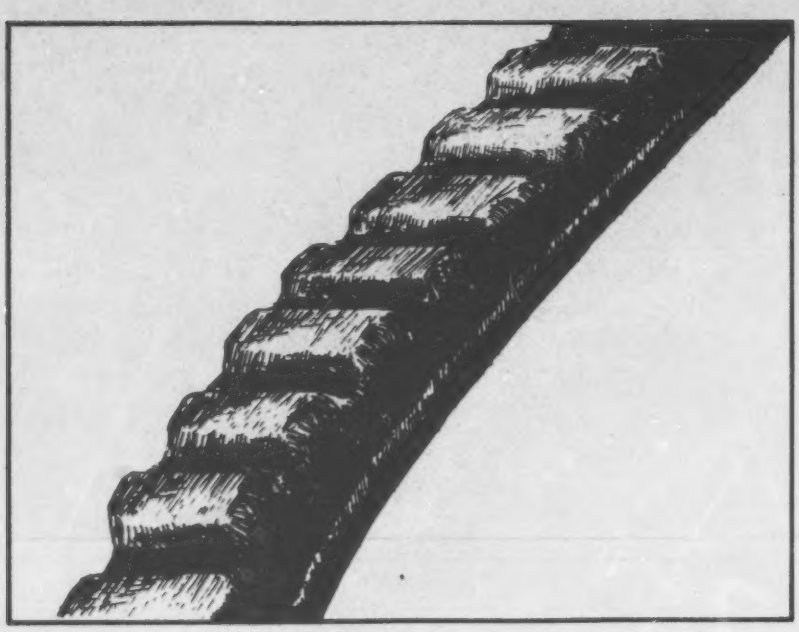
BELT FAILURE

EXCESSIVE WEAR ON TOP EDGE



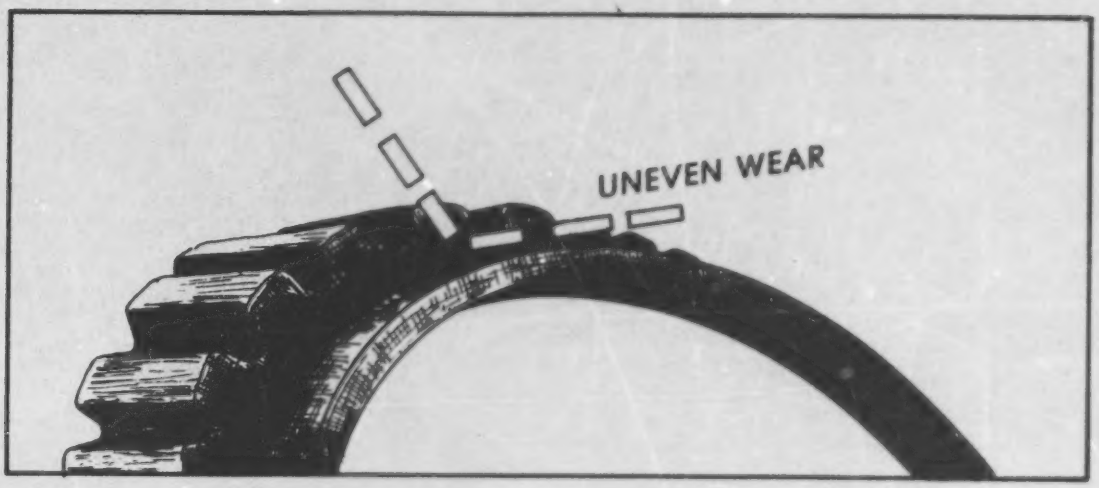
BELT FAILURE

EXCESSIVE GLAZE OR BAKING ON SIDES



BELT FAILURE

UNEVEN BELT WEAR ON ONE SIDE OF BELT



FAILURES AND CAUSES OF BELT DAMAGE

A. Belt flip-over	1. Improper pulley alignment 2. Excessive belt speed
B. Sheared cogs	1. Belt rubbing stationary objects on pulleys
C. Cracks between cogs	1. Belt wearing out
D. Edge cord breakage	1. Improper pulley alignment
E. Belt disintegration	1. Excessive belt speed
F. Belt worn narrow only in one spot	1. Improper pulley distance 2. Track frozen 3. Engine clutch not working properly
G. Excessive wear only on top edge	1. Rough pulley surfaces
H. Excessive glaze or baking of sides	1. Insufficient pressure on belt sides
I. Uneven belt wear on one side	1. Improper pulley alignment

DRIVE BELTS
UNIT II

JOB SHEET #1--REMOVAL AND REPLACEMENT OF A DRIVE BELT

I. Tools and materials needed

A. Medium size phillips and standard screwdrivers

B. Ball peen hammer

C. Combination wrench set

D. Snowmobile with drive belt installed

II. Procedure

A. Remove any shields that enclose either the engine clutch or the drive assembly by removing any bolts, pins or wing nuts

(NOTE: Use whichever applies.)

B. Pry the driven pulley apart so that the drive belt can be pulled upward to the center of the pulley, allowing the belt to have slack

C. Push the top of the belt over the inner half of the drive pulley and pushing down, remove it from the drive pulley

D. Slip the belt off the driven clutch assembly

(NOTE: On some models it may be necessary to loosen the engine's motor mount bolts to obtain enough clearance.)

III. Reassembly--Reverse above procedures

DRIVE BELTS
UNIT II

TEST

1. Match terms on the right to the correct definition.

___ a. Distance between engine clutch and driver pulley assembly

___ b. Rubber belt used to transfer the power from the engine to the track

___ c. Used to eliminate slippage of the belts on pulley halves and add to the belt's flexibility

___ d. Belt overriding pulleys which is caused by pulleys being too close together or drive belt too long

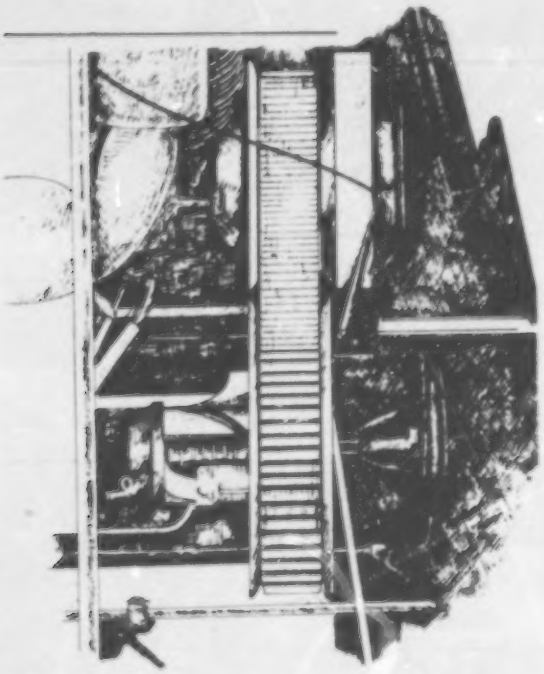
___ e. Heavy reinforcement material molded into the drive belt for longer belt wear and strength

___ f. Drive belt flies to pieces while snowmobile is in action

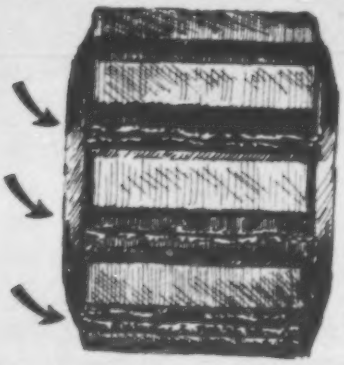
1. Cogs
2. Drive belt
3. Belt disintegration
4. Belt ride out
5. Pulley distance
6. Cords

2. Identify the following belt failures.

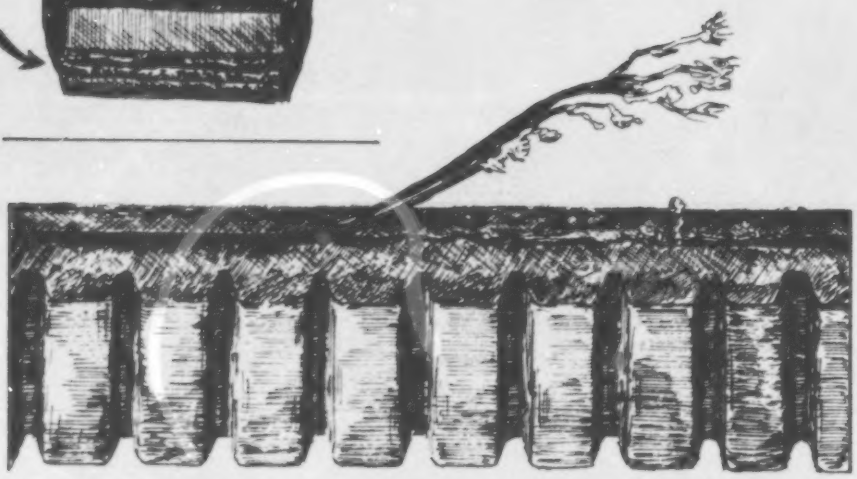
a. _____



b. _____

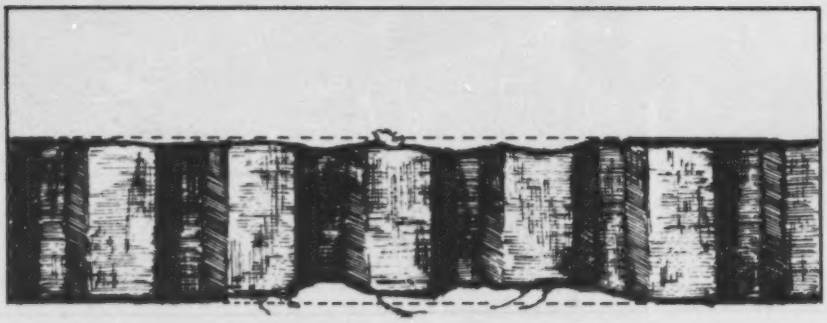


c. _____

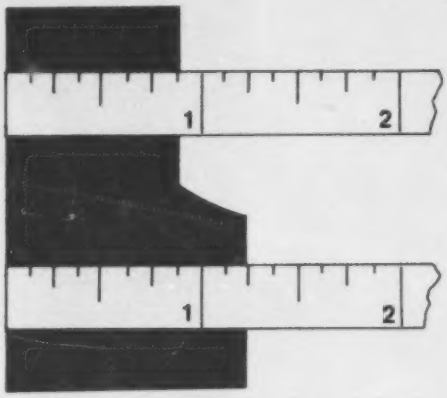


d. _____

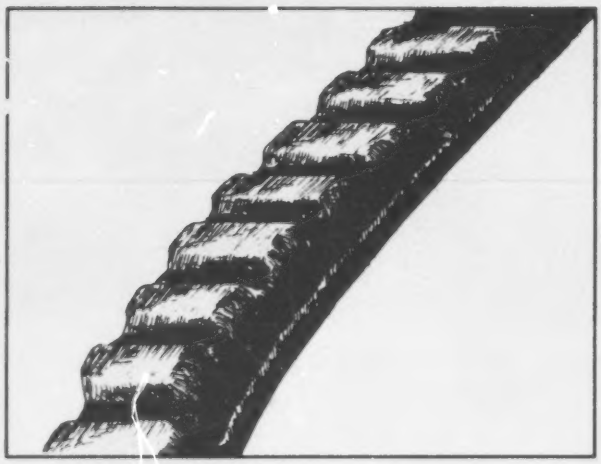
e. _____



f. _____

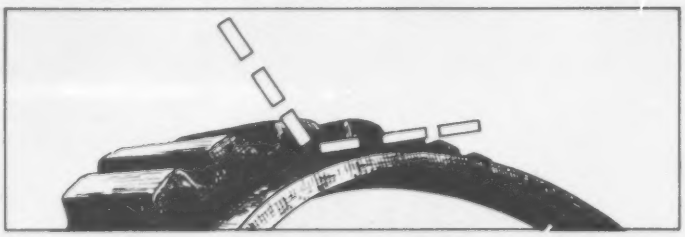


g. _____



h. _____

i. _____



3. Match the causes of belt failures on the right to the term identifying belt failures. (NOTE: There may be more than one cause per failure. It will be specified where more than one answer is needed by having two or more lines beneath the failure listed.)

a. Uneven belt wear on one side _____

b. Excessive glaze or baking of sides _____

c. Excessive wear only on one side _____

d. Belt worn narrow only in one spot _____ _____ _____

e. Belt disintegration _____

f. Edge cord breakage _____

g. Cracks between cogs _____

h. Sheared cogs _____

i. Belt flip over _____ _____

1. Rough pulley surface
2. Improper pulley alignment
3. Improper pulley distance
4. Track frozen
5. Insufficient pressure on belt sides
6. Engine clutch not working properly
7. Excessive belt speed
8. Belt rubbing stationary objects on pulley
9. Belt wearing out

4. Describe when replacement of a drive belt is necessary.

5. Demonstrate the ability to:

a. Remove a drive belt from any given snowmobile.

b. Replace a drive belt on any given snowmobile.

(NOTE: If these activites have not been accomplished prior to the test, ask the instructor when they should be completed.)

DRIVE BELTS
UNIT II

ANSWERS TO TEST

1. a. 5
   b. 2
   c. 1
   d. 4
   e. 6
   f. 3
2. a. Flip over at high speed
   b. Sheared cogs
   c. Cracks between cogs
   d. Edge cord breakage
   e. Disintegration
   f. Worn narrow in one section
   g. Excessive wear on top edge
   h. Excessive glaze or baking on sides
   i. Uneven belt wear on one side of belt
3. a. 2
   b. 5
   c. 1
   d. 3, 4, 6
   e. 7
   f. 2
   g. 9
   h. 8
   i. 2, 7

4. Replacement of a drive belt is necessary when any of the nine types of failures occur.

5. Evaluated to the satisfaction of the instructor.

DRIVE BELT ADJUSTMENT AND ALIGNMENT
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to adjust and align any drive belt on any given snowmobile. This knowledge will be evidenced by demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with belt alignment and adjustment.
2. Name four ways of adjusting belt alignment and offset.
3. Demonstrate the ability to:
   a. Adjust the alignment of pulleys.
   b. Adjust the offset of pulleys.

DRIVE BELT ADJUSTMENT AND ALIGNMENT
UNIT III

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information and job sheets
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information and job sheets
- F. Demonstrate adjustment of pulley offset and distance
- G. Give test

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheet
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1--Pulley Distance
  2. TM 2--Pulley Offset
- D. Job Sheet #1--Adjustment, Alignment and Offset of Drive Belt Pulleys

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

DRIVE BELT ADJUSTMENT AND ALIGNMENT
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Pulley distance--Distance between the engine clutch inner half and the driven pulley on the chain case at the closest point

B. Pulley offset--Distance that the engine clutch is offset to the driven pulley so that the belt will run true at all speeds

C. Misalignment--Offset of the engine clutch to the driven pulley is incorrect

D. Shimming--Installing or removing shims behind the chaincase or on the engine clutch to correct pulley offset

E. Overriding--Caused by the drive belt being too long or the pulley and clutch being too close together

II. Four ways of adjusting belt alignment and offset

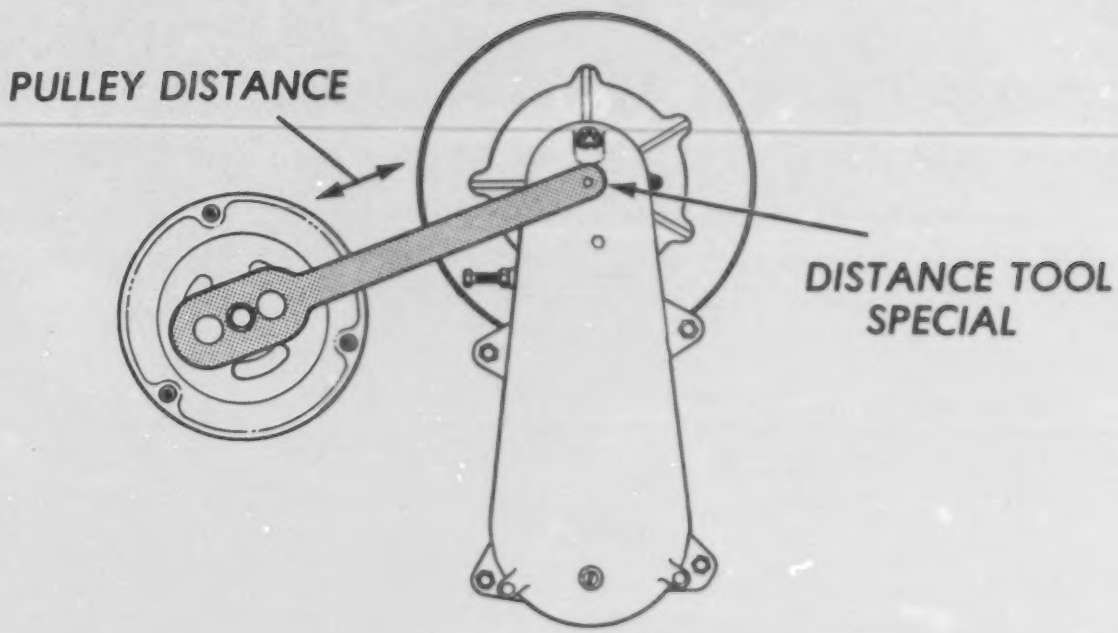
A. Shimming of the clutch inner half

B. Shimming the chain case assembly (if applicable)

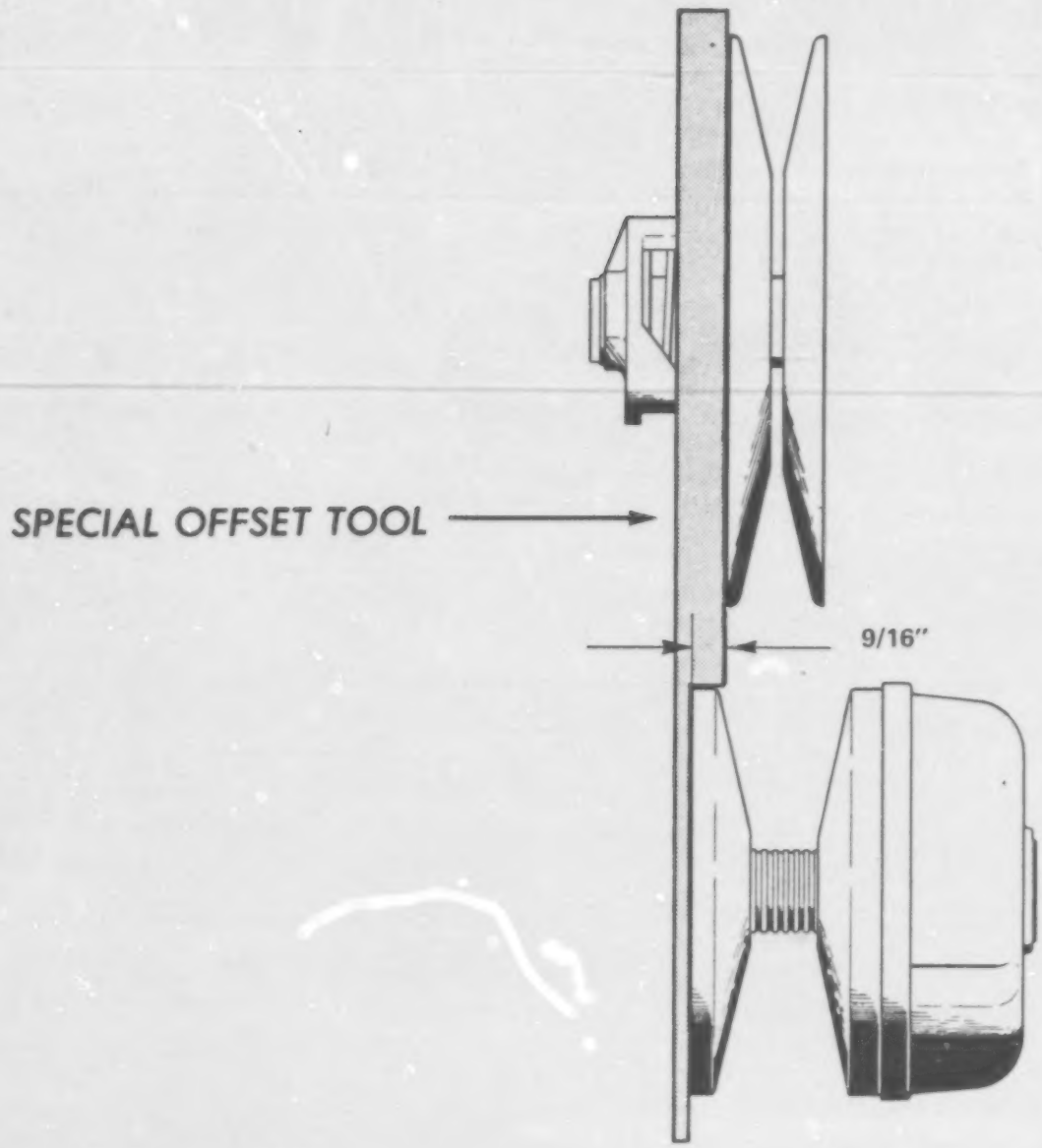
C. Moving the engine motor mounts

D. Turning chain case to adjust pulley distance

PULLEY DISTANCE



PULLEY OFFSET



DRIVE BELT ADJUSTMENT AND ALIGNMENT
UNIT III

JOB SHEET #1--ADJUSTMENT, ALIGNMENT AND OFFSET OF DRIVE BELT PULLEYS

I. Tools and materials needed

A. Alignment tool designed for snowmobile

B. Shims (if applicable)

C. Combination wrench set

D. Clutch puller (if applicable)

E. Mallet

F. 3/8" drive socket set

G. Snowmobile complete with engine and pulley assemblies

II. Procedure

A. Measure offset of pulley and engine clutch by using the proper tool that is specified by manufacturer

B. Determine if shims can be removed or replaced from behind the chain case or engine clutch

C. Remove the clutch assembly if it uses shims (if applicable)

D. Use the correct amount of shims to correct the offset

E. Loosen chain case mounting bolts if shims can be removed or replaced to correct offset

F. Measure alignment between engine clutch and pulley assembly before tightening chain case bolts

G. Tighten chain case bolts securely

(NOTE: If shims are not used to correct misalignment and offset, the engine will have to be shifted on its motor mounts to be corrected.)

DRIVE BELT ADJUSTMENT AND ALIGNMENT
UNIT III

TEST

1. Match the terms on the right to the correct definition.

___ a.	Offset of the engine clutch to the driven pulley is incorrect	1. Pulley offset
___ b.	Installing or removing shims behind the chain case on the engine clutch to correct pulley offset	2. Misalignment
___ c.	Distance that the engine clutch is offset to the driven pulley so that the belt will run true at all speeds	3. Overriding
___ d.	Distance between the engine clutch inner half and the driven pulley on the chain case at the closest point	4. Pulley distance
___ e.	Caused by the drive belt being too long or the pulley and clutch being too close together	5. Shimming

2. Name four ways of adjusting belt alignment and offset.

   a.

   b.

   c.

   d.

3. Demonstrate the ability to:

   a. Adjust the alignment of a drive belt.

   b. Adjust the offset of pulleys.

   (NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

DRIVE BELT ADJUSTMENT AND ALIGNMENT
UNIT III

ANSWERS TO TEST

1. a. 2
   b. 5
   c. 1
   d. 4
   e. 3
2. a. Shimming of the clutch inner half
   b. Shimming of the chain case assembly
   c. Moving the engine motor mounts
   d. Turning chain case to adjust the pulley distance
3. Evaluated to the satisfaction of the instructor

DRIVEN CLUTCH ASSEMBLY
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify all the main parts of a typical driven clutch assembly. The student should be able to disassemble, reassemble and check the operation of a typical driven clutch assembly. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a driven clutch assembly to the correct definition.
2. Identify all the main parts of a driven clutch assembly when given a drawing illustrating the parts.
3. Describe procedure for replacing cam or ram slider bushings.
4. Describe three ways of determining if a driven clutch spring needs replacement.
5. Demonstrate the ability to:
   a. Disassemble a typical driven clutch assembly.
   b. Reassemble a typical driven clutch assembly.

DRIVEN CLUTCH ASSEMBLY
UNIT IV

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information and job sheets
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information and job sheets
- F. Demonstrate procedures outlined in job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency Master #1--Main Parts of a Typical Driven Clutch Assembly
- D. Job sheets
  1. Job Sheet #1--Disassemble a Typical Driven Clutch Assembly

2. Job Sheet #2--Reassemble a Typical Driven Clutch Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

DRIVEN CLUTCH ASSEMBLY
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Fixed clutch half--Usually containing a shaft which is supported by bearings and connects to the chain case sprocket to deliver power to the track

B. Sliding clutch half--Portion of the clutch assembly which receives the clutch spring to keep a constant pressure on the drive belt

C. Spring--Attaches between the cam or ramp and the sliding half and keeps a constant inward pressure on the sliding half

D. Outer cam or ramp--Enables sliding clutch half to slide so that the drive belt can move freely up and down the driven clutch with a constant pressure

E. Cam or ramp slider bushing--Usually made of nylon or plastic and attaches to the cam or ramp to eliminate friction between the sliding half and ramp

F. Cam or ramp retainer--Roll pin or snap ring that holds the cam or ramp onto the shaft of the fixed clutch half

II. Main parts of a typical driven clutch assembly (Transparency 1)

A. Fixed clutch half

B. Sliding clutch half

C. Bushing

D. Spring

E. Cam or ramp

F. Cam or ramp slider bushing

G. Cam or ramp retainer

III. Procedure for replacing cam or ramp slider bushings

A. Drive them out with a small pin punch

B. Replace all bushings each time one needs to be replaced

(NOTE: This ensures even wear on all bushings.)

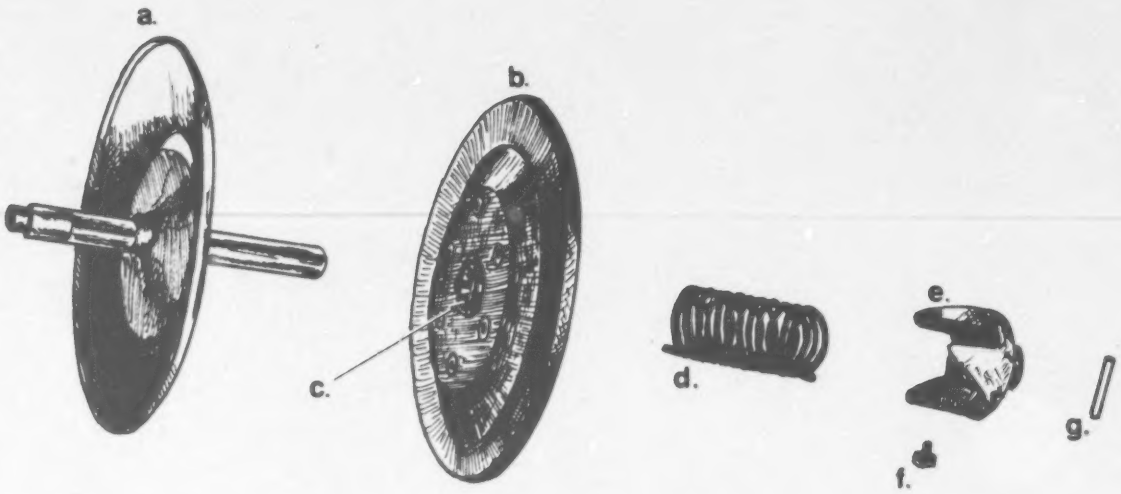
IV. Ways of determining if a driven clutch spring needs replacement

A. Belt drops down quickly into center of driven clutch upon acceleration and engine loses power

B. Snowmobile will jerk upon acceleration

C. Drive belt will become glazed on its side

Main Parts of a Typical Driven Clutch Assembly



a. FIXED CLUTCH HALF
b. SLIDING CLUTCH HALF
c. BUSHING
d. SPRING
e. CAM OR RAMP
f. CAM OR RAMP SLIDER BUSHING
g. CAM OR RAMP RETAINER

DRIVE CLUTCH ASSEMBLY
UNIT IV

JOB SHEET #1--DISASSEMBLE A TYPICAL DRIVEN CLUTCH ASSEMBLY

I. Tools and materials needed

A. Combination wrench set

B. 3/8" drive socket set

C. Pin punch

D. Mallet

E. Snap ring pliers

F. Needle nose pliers

G. Driven clutch assembly on snowmobile

II. Procedure

A. Drain chain case oil (if necessary)

B. Remove brake unit if attached to clutch assembly

C. Remove muffler if applicable

D. Remove chain case side cover or inspection cover

E. Remove upper sprocket from driven clutch shaft

F. Remove any bolts holding chain tensioner into clutch assembly, if applicable

G. Slide out clutch assembly from chain case

H. Remove roll pin or snap ring from cam or ramp

(NOTE: This unit is spring loaded and care should be taken in this step.)

I. Note position of spring to determine if there is more than one hole for it to be inserted

J. Slide off sliding half

K. Check bushing for wear according to manufacturer's specifications

L. Check cam or ramp slider

(NOTE: Replace if worn.)

DRIVEN CLUTCH ASSEMBLY
UNIT IV

JOB SHEET #2--REASSEMBLE A TYPICAL DRIVEN CLUTCH ASSEMBLY

I. Tools and materials needed

A. Combination wrench set

B. 3/8" drive socket set

C. Pin punch

D. Mallet

E. Snap ring pliers

F. Needle nose pliers

G. Driven clutch assembly on snowmobile

II. Procedure

A. Replace cam or ramp bushing, if worn

B. Replace sliding half bushing if necessary

C. Install sliding half onto fixed clutch shaft

D. Install clutch spring and cam or ramp

(NOTE: Be certain that the assembly has the right amount of spring tension before installing retainer.)

E. Install clutch assembly into chain case

F. Install socket on clutch

G. Install new cotter pin, if applicable

H. Install chain tension bolt and check chain tension, if applicable

I. Install inspection cover on chain case side cover

J. Fill with oil, if necessary

K. Check operation

DRIVEN CLUTCH ASSEMBLY
UNIT IV

TEST

1. Match the terms on the right to the correct definition.

___ a. Portion of the clutch assembly which receives the clutch spring to keep a constant pressure on the drive belt

___ b. Usually made of nylon or plastic and attaches to the cam or ramp to eliminate friction between the sliding half and ramp

___ c. Attaches between the cam or ramp and sliding half and keeps a constant inward pressure on the sliding half

___ d. Enables sliding clutch half to slide on this so that the drive belt can move freely up and down the driven clutch with a constant pressure

___ e. Holds the cam or ramp onto the shaft of the fixed clutch half

___ f. Usually containing a shaft which is supported by bearings and connects to the chain case and sprocket to deliver power to the track

1. Outer cam or ramp
2. Sliding clutch half
3. Cam or ramp slider bushing
4. Fixed clutch half
5. Cam or ramp retainer
6. Spring

2. Identify all the main parts of a typical driven clutch assembly.

   a.

   b.

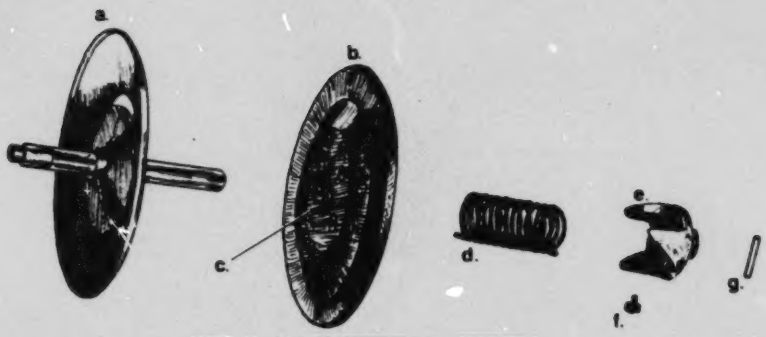
   c.

   d.

   e.

   f.

   g.



3. Describe the procedure for replacing cam or ramp slider bushings.

4. Describe three ways of determining if a driven clutch spring needs replacement.

   a.

   b.

   c.

5. Demonstrate the ability to:

   a. Disassemble a typical driven clutch assembly.

   b. Reassemble a typical driven clutch assembly.

   (NOTE: If these activities have not be accomplished prior to the test, ask the instructor when they should be completed.)

DRIVEN CLUTCH ASSEMBLY
UNIT IV

ANSWERS TO TEST

1. a. 2
   b. 3
   c. 6
   d. 1
   e. 5
   f. 4
2. a. Fixed clutch half
   b. Sliding clutch half
   c. Bushing
   d. Spring
   e. Cam or ramp
   f. Cam or ramp slider bushing
   g. Cam or ramp retainer
3. When replacing cam or ramp slider bushings it is necessary to drive them out with a small pin punch.
4. a. Belt drops down quickly into center of driven clutch upon acceleration and loses power
   b. Snowmobile will jerk upon acceleration
   c. Drive belt will become glazed on its sides
5. Evaluated to the satisfaction of the instructor.

DRIVEN CLUTCH BEARING REPLACEMENT
UNIT V

UNIT OBJECTIVE

After completion of this unit, the student should be able to remove and replace any driven clutch bearing on any given snowmobile. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Name two types of bearings used on driven clutch assemblies.
2. Describe three ways of determining when replacement of a driven clutch bearing would be necessary.
3. Demonstrate the ability to:
   a. Remove a driven clutch bearing.
   b. Replace a driven clutch bearing.

DRIVEN CLUTCH BEARING REPLACEMENT
UNIT V

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheet
- G. Give test

II. Student

- A. Read objectives
- B. Read information sheet
- C. Complete job sheet
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1a--Tapered Cone Bearing with Race
  2. TM 1b--Sealed Type Roller Bearing
- D. Job Sheet #1--Remove and Replace a Driven Clutch Bearing

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

DRIVEN CLUTCH BEARING REPLACEMENT
UNIT V

INFORMATION SHEET

I. Types of bearings used on driven clutch assemblies

   A. Tapered cone type with race

   B. Sealed type

      (NOTE: This is a roller bearing.)

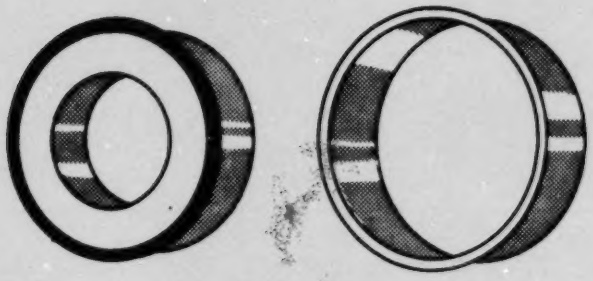
II. When to replace driven clutch bearing

   A. Driven clutch assembly has severe run out

   B. Drive chain failure caused fragments of chain to enter bearing

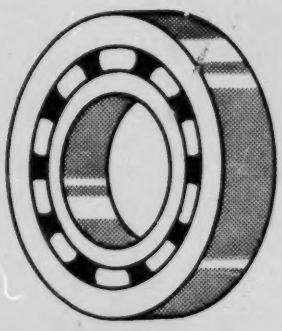
   C. Lack of lubrication to bearing

Tapered Cone Bearing with Race



TM - 1a

Sealed Type Roller Bearing



TM - 1b

DRIVEN CLUTCH BEARING REPLACEMENT
UNIT V

JOB SHEET #1--REMOVE AND REPLACE A DRIVEN CLUTCH BEARING

I. Tools and materials needed

A. Combination wrench set

B. 3/8" drive socket set

C. Pin punch

D. Mallet

E. Drive clutch assembly on snowmobile

II. Procedure

A. Remove driven clutch assembly from snowmobile

B. Determine if bearing is a tapered cone or a sealed type

C. Remove bearing from chain case with puller (if applicable)

D. If tapered type bearing is used, drive out old race with pin punch and use a bushing driver to reinstall

E. Reinstall bearing

F. Reinstall driven clutch assembly

G. Reinstall drive chain and cover

H. Check operation

DRIVEN CLUTCH BEARING REPLACEMENT
UNIT V

TEST

1. Name two types of bearings used on driven clutch assemblies.

   a.

   b.

2. Describe three ways of determining when replacement of a driven clutch bearing would be necessary.

   a.

   b.

   c.

3. Demonstrate the ability to:

   a. Remove and replace a driven clutch bearing.

   (NOTE: If this activity has not been accomplished prior to the test, ask the instructor when it should be completed.)

DRIVEN CLUTCH BEARING REPLACEMENT
UNIT V

ANSWERS TO TEST

1. a. Tapered cone type

   b. Sealed roller type

2. a. Driven clutch has severe run out

   b. Drive chain failure caused fragments of chain to enter bearing

   c. Lack of lubrication to bearing

3. Evaluated to the satisfaction of the instructor.

CHAIN CASE ASSEMBLIES
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify all the main parts of a typical chain case assembly. The student should be able to disassemble and reassemble a typical chain case assembly. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical chain case assembly to the correct definition.
2. Name two types of chain cases.
3. Identify all the main parts of a typical chain case assembly when given a drawing illustrating the parts.
4. Demonstrate the ability to:
   a. Disassemble a typical chain case assembly.
   b. Reassemble a typical chain case assembly.

CHAIN CASE ASSEMBLIES
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined on job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Read information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1--One Piece Chain Case Assembly
  2. TM 2--Two Piece Chain Case Assembly
  3. TM 3--Main Parts of a Typical Chain Case Assembly

D. Job sheets

1. Job Sheet #1--Disassemble a Typical Chain Case Assembly

2. Job Sheet #2--Reassemble a Typical Chain Case Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

CHAIN CASE ASSEMBLIES
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Chain case--Steel or aluminum molded case in which oil is held to lubricate the drive chain and the bearings which support the driven clutch assembly and drive axle

B. Chain tensioner--Automatic or manually adjusted device used to keep a specified tension on the drive chain

C. Drive chain--Used to transfer the engine power from the driven clutch assembly to the drive axle

D. Sprocket--A unit with teeth that is attached to the driven clutch shaft and drive axle on which the drive chain connects

E. Oil seals--Prevent any leakage of oil from the chain case where the drive axle and driven clutch shaft enter

F. O-ring--Used to seal the surfaces between the chain case and chain case cover to prevent any oil leakage

G. Plug--Used to check for proper oil level within the chain case

II. Types of chain cases

A. One piece chain case (Transparency 1)

(NOTE: This has an inspection cover and does not expose the chain and sprockets.)

B. Two piece chain case (Transparency 2)

(NOTE: This exposes the drive chain and sprockets.)

III. Main parts of a typical chain case assembly (Transparency 3)

A. Chain case

B. Chain case cover

C. Bearings

D. Chain tensioner

INFORMATION SHEET

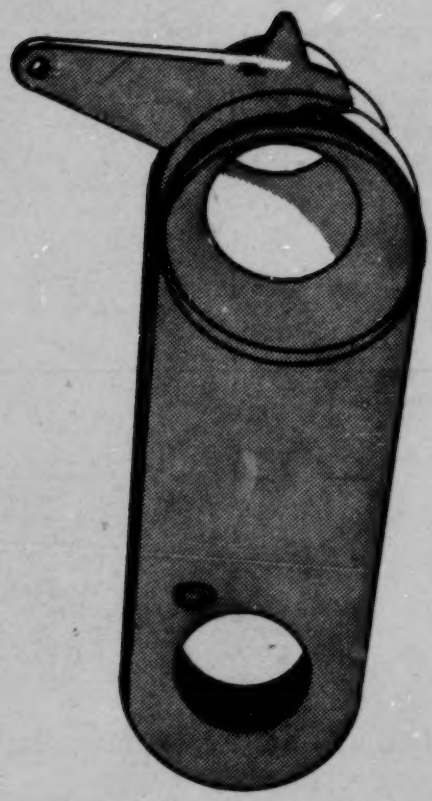
E. Sprockets

F. Chain

G. Plug

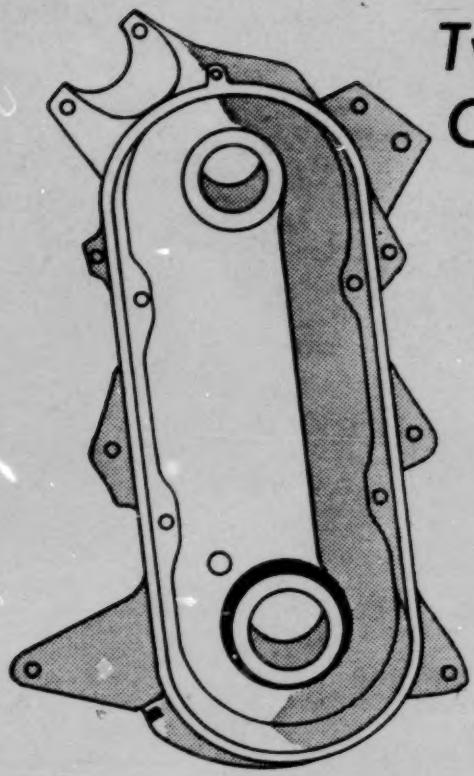
H. Oil seals

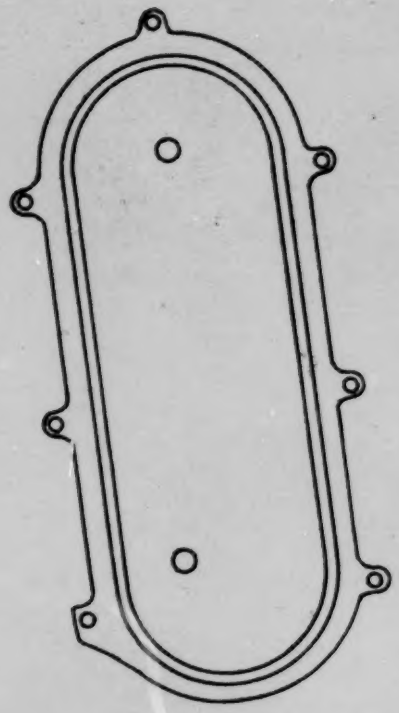
I. Chain tensioner spring

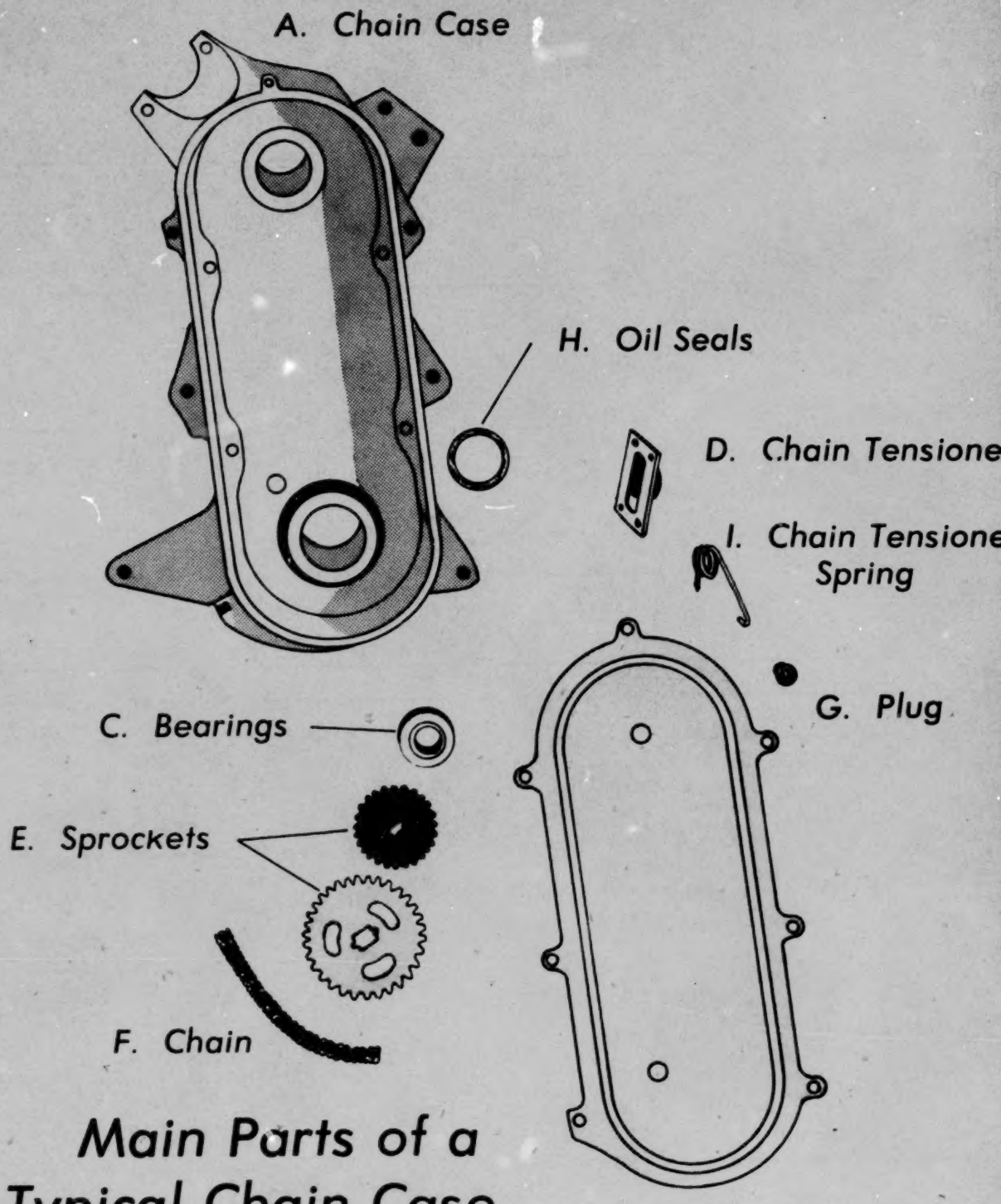


One-Piece Chain Case Assembly

Two-Piece Chain Case Assembly







Main Parts of a Typical Chain Case Assembly

CHAIN CASE ASSEMBLIES
UNIT I

JOB SHEET #1--DISASSEMBLE A TYPICAL CHAIN CASE ASSEMBLY

I. Tools and materials needed

A. Chain case assembly on snowmobile

B. 3/8" drive socket set

C. Combination wrench set

D. Phillips and standard screwdrivers

II. Procedure

A. Drain oil from chain case

B. Remove outside chain case cover (if applicable)

C. Remove bolts, nuts or cotter pins holding sprockets onto shafts

D. Remove chain tensioner

E. Remove sprockets and drive chain

F. Remove rear seal from chain case

(NOTE: Track tension will need to be released at this point if applicable.)

G. Remove chain case mounting bolts

H. Remove chain case from snowmobile

(NOTE: On disc brake type, brake unit may need to be removed from chain case.)

I. Check all bearings for possible wear

J. Clean all parts for reassembly

CHAIN CASE ASSEMBLIES
UNIT I

JOB SHEET #2--REASSEMBLE A TYPICAL CHAIN CASE ASSEMBLY

I. Tools and materials needed

A. 3/8" drive socket set

B. Combination wrench set

C. Phillips and standard screwdrivers

D. Side cutters

E. Cotter pins (if applicable)

II. Procedure

A. Install chain case onto snowmobile

B. Install chain case mounting bolts

C. Reinstall rear chain case seal (if applicable)

D. Install disc brake unit (if applicable)

E. Reinstall sprockets and drive chain

F. Install sprocket mounting bolts, nuts or cotter pins (whichever applies)

G. Install chain tensioner and adjust chain tension to the manufacturer's specifications

H. Reinstall chain case cover

I. Fill chain case with oil to the proper level, according to the manufacturer's specifications

J. Check operation

K. Check for possible oil leaks

CHAIN CASE ASSEMBLIES
UNIT I

TEST

1. Match the terms on the right to the correct definition.

___ a. Used to check for proper oil level within the chain case

___ b. Automatic or manually adjusted device used to keep a specified tension on the drive chain

___ c. Used to transfer the engine power from the driven clutch assembly to the drive axle

___ d. Used to seal the surfaces between the chain case and chain case cover to prevent any oil leakage

___ e. Applies a constant pressure to the chain tensioner to assure proper chain tension

___ f. Prevent any leakage of oil from the chain case where the drive axle and drive clutch shaft enter

___ g. A unit with teeth that is attached to the driven clutch shaft and drive axle on which the drive chain connects

___ h. Steel or aluminum molded case in which oil is held to lubricate the drive chain and the bearings which support the drive clutch assembly and drive axle

1. O-ring
2. Chain case
3. Oil seals
4. Plug
5. Chain tensioner
6. Sprockets
7. Drive chain
8. Chain tensioner spring

2. Name two types of chain cases.

a.

b.

3. Identify all the main parts of a typical chain case assembly.

a.

b.

c.

d.

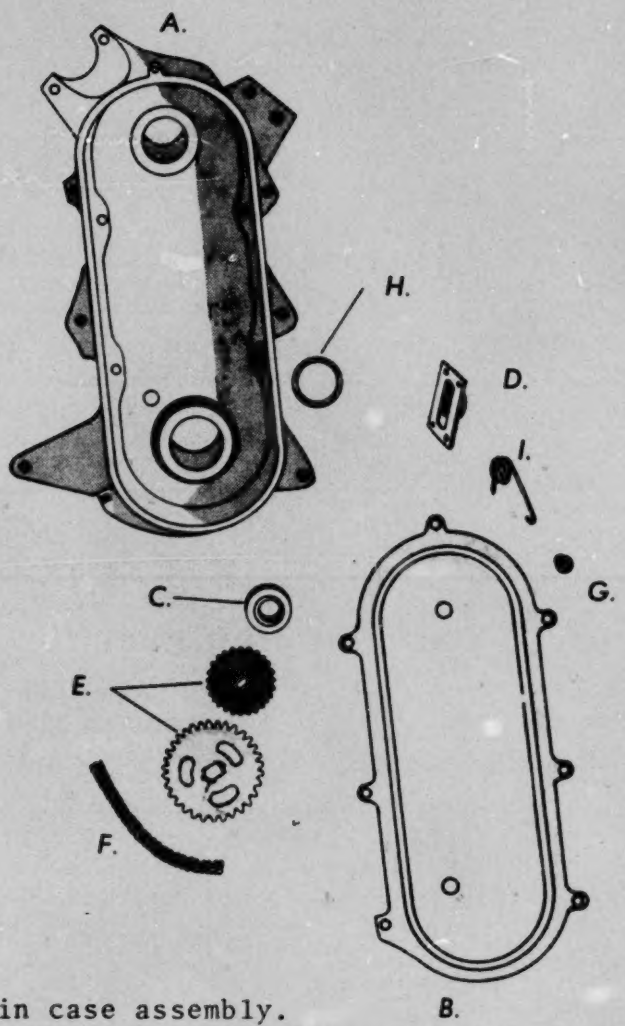
e.

f.

g.

h.

i.



4. Demonstrate the ability to:

a. Disassemble a typical chain case assembly.

b. Reassemble a typical chain case assembly.

(NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

CHAIN CASE ASSEMBLIES
UNIT I

ANSWERS TO TEST

1. a. 4
   b. 5
   c. 7
   d. 1
   e. 8
   f. 3
   g. 6
   h. 2
2. a. One piece chain case
   b. Two piece chain case
3. a. Chain case
   b. Chain case cover
   c. Bearings
   d. Chain tensioner
   e. Sprockets
   f. Chains
   g. Plug
   h. Oil seals
   i. Chain tensioner spring
4. Evaluated to the satisfaction of the instructor.

CHAIN REPLACEMENT
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to replace a drive chain on any given snowmobile. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Name five causes of drive chain failure.
2. Name three types of drive chains used on snowmobiles.
3. Identify the three types of drive chains used on snowmobiles when given an illustration.
4. Demonstrate the ability to:
   a. Remove a drive chain on any given snowmobile.
   b. Install a drive chain on any given snowmobile.

CHAIN REPLACEMENT
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Read information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1a--Single Roller Chain
  2. TM 1b--Double Roller Chain
  3. TM 1c--Triple Roller Chain

D. Job sheets

1. Job Sheet #1--Remove a Drive Chain

2. Job Sheet #2--Install a Drive Chain

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

CHAIN REPLACEMENT
UNIT II

INFORMATION SHEET

I. Causes of chain failure

- A. Improper tension applied to chain
- B. Worn bearings within chain case
- C. Worn sprockets
- D. Rapid acceleration
- E. Locking of the tract

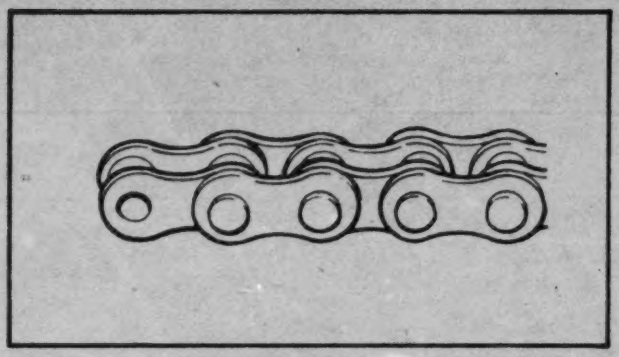
II. Types of drive chains on snowmobiles

- A. Single roller chain
- B. Double roller chain
- C. Triple roller chain

III. Types of drive chains

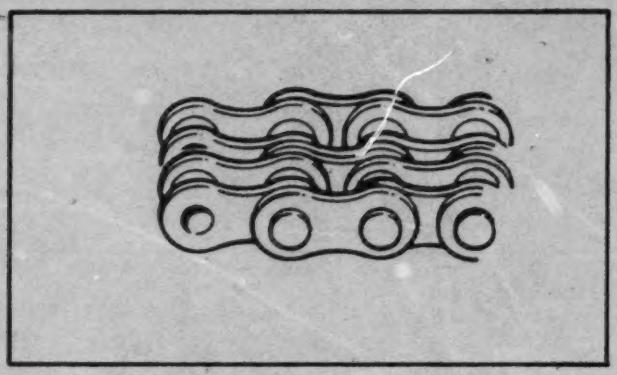
- A. Singer roller chain (Transparency 1a)
- B. Double roller chain (Transparency 1b)
- C. Triple roller chain (Transparency 1c)

SINGLE ROLLER CHAIN



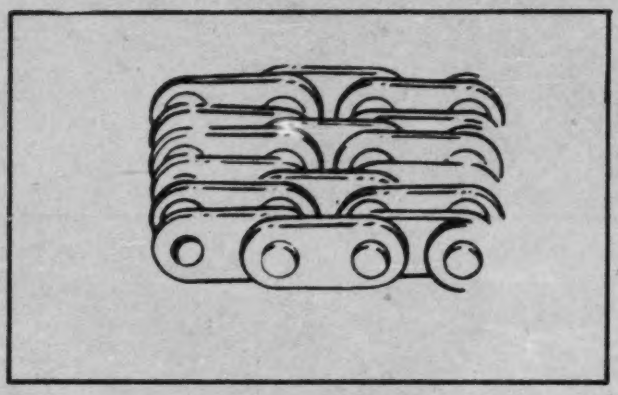
TM - 1a

DOUBLE ROLLER CHAIN



TM - 1b

TRIPLE ROLLER CHAIN



TM - 1c

CHAIN REPLACEMENT
UNIT II

JOB SHEET #1--REMOVE A DRIVE CHAIN

I. Tools and materials needed

A. Combination wrench set

B. Side cutters

C. 3/8" drive socket set

D. Chain case on snowmobile

II. Procedure

A. Drain oil from chain case

B. Remove chain case cover (if applicable)

C. Remove chain tensioner

(NOTE: This applies to automatic or manual types.)

D. Remove any bolts, nuts or cotter pins holding the sprockets (if applicable)

E. Remove sprockets and chain assembly at the same time by sliding off of the spline

F. Remove chain from sprockets

G. Inspect chain for any possible damage

CHAIN REPLACEMENT
UNIT II

JOB SHEET #2--INSTALL A DRIVE CHAIN

I. Tools and materials needed

A. Combination wrench set

B. Side cutters

C. 3/8" drive socket set

D. Cotter pins (if applicable)

II. Procedure

A. Clean chain case, chain and sprockets thoroughly

B. Install chain onto sprockets

C. Insert sprockets onto shafts

D. Install nuts, bolts or cotter pins to hold sprockets on the shaft

E. Reinstall chain tensioner

(NOTE: This applies to automatic or manual types.)

F. Set manual chain tensioner to the manufacturer's specifications

G. Reinstall chain case cover

H. Fill chain case with oil according to the manufacturer's specifications

I. Check operation

CHAIN REPLACEMENT
UNIT II

TEST

1. Name five causes of drive chain failure.

   a.

   b.

   c.

   d.

   e.

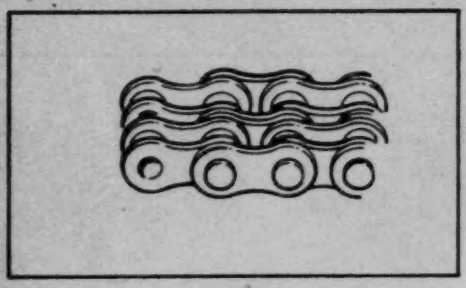
2. Name three types of drive chains used on snowmobiles.

   a.

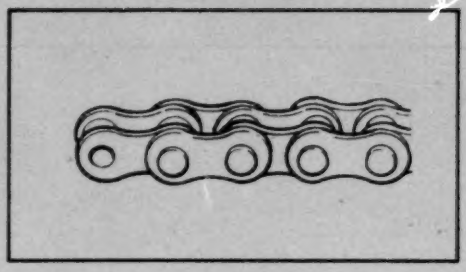
   b.

   c.

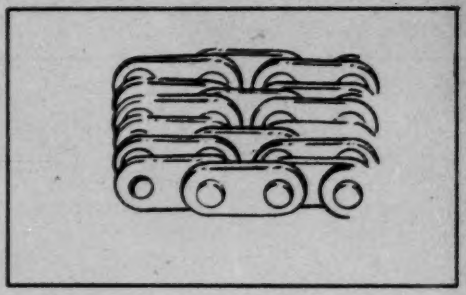
3. Identify the following types of drive chains.



a._____



b._____



c._____

4. Demonstrate the ability to:

   a. Remove drive chain on any given snowmobile.

   b. Install a drive chain on any given snowmobile.

   (NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

CHAIN REPLACEMENT
UNIT II

ANSWERS TO TEST

1. a. Improper tension applied to chain
   b. Worn bearings within the chain case
   c. Worn sprockets
   d. Rapid acceleration
   e. Locking of the track
2. a. Single roller chain
   b. Double roller chain
   c. Triple roller chain
3. a. Double roller chain
   b. Single roller chain
   c. Triple roller chain
4. Evaluated to the satisfaction of the instructor.

CHAIN REPAIR
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify all the parts of a drive chain and repair any drive chain. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical drive chain to the correct definition.
2. Identify the six types of drive chain links when given an illustration.
3. Name two types of drive chains.
4. Identify the basic parts of a drive chain.
5. Demonstrate the ability to repair any single, double or triple drive chain.

CHAIN REPAIR
UNIT III

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheet
- G. Give test

II. Student

- A. Read objectives
- B. Read information sheet
- C. Complete job sheet
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1a--Single Connector Link
  2. TM 1b--Single Half Link
  3. TM 1c--Double Connector Link
  4. TM 1d--Double Half Link

5. TM 1e--Triple Connector Link

6. TM 1f--Triple Half Links

7. TM 2--Basic Parts of a Drive Chain

D. Job Sheet #1--Repair a Drive Chain

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

CHAIN REPAIR
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Connector link--Used to connect a drive chain together

B. Half link--Used to shorten a drive chain by replacing a full link with this link

C. Cotter pin--Used to hold a connector link or half link pin in place

D. Clip--Used to hold outer link in position

E. Pin--Used to connect either a half link or connector link

F. Endless chain--Chain having no connector links

G. Detachable chain--Chain containing connector links

II. Types of drive chain links

A. Single connector link (Transparency 1a)

B. Single half link (Transparency 1b)

C. Double connector link (Transparency 1c)

D. Double half link (Transparency 1d)

E. Triple connector link (Transparency 1e)

F. Triple half link (Transparency 1f)

III. Types of drive chains

A. Endless

B. Detachable

IV. Basic parts of a drive chain (Transparency 2)

A. Single link pin

B. Half link

C. Outer link

INFORMATION SHEET

D. Clip

E. Cotter pin

F. Connector link

G. Complete chain section

TYPICAL SNOWMOBILE CHAIN LINKS

SINGLE CONNECTOR LINK
TM - 1a

SINGLE HALF LINK
TM - 1b

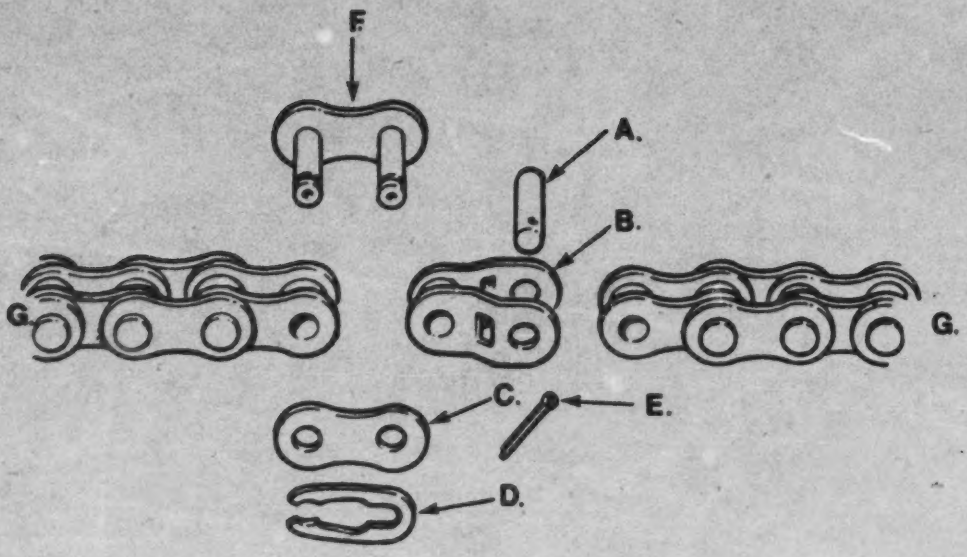
DOUBLE CONNECTOR LINK
TM - 1c

DOUBLE HALF LINK
TM - 1d

TRIPLE CONNECTOR LINK
TM - 1e

TRIPLE HALF LINK

Parts of a Drive Chain



A. SINGLE LINK PIN
B. HALF LINK
C. OUTER LINK
D. CLIP
E. COTTER PIN
F. CONNECTOR LINK
G. COMPLETE CHAIN SECTION

CHAIN REPAIR
UNIT III

JOB SHEET #1--REPAIR A DRIVE CHAIN

I. Tools and materials needed

A. Snowmobile

B. Drive chain

C. Combination wrench set

D. 3/8" drive socket set

E. Half link

F. Connector link

G. Cotter pin

H. Pin punch

I. Ball peen hammer

J. Suitable grinder

II. Procedure

A. Remove drive chain from snowmobile

B. Clean all broken chain parts, chips and shavings from chain case

C. Check drive chain to determine if it is endless or a detachable type chain

(NOTE: Check for connector link.)

D. Determine the number of links that will need to be replaced

E. Determine if drive chain is worth repairing or replacing

F. Grind off full connector link if chain is to be repaired

G. Replace with as many full links as needed and half links if needed

JOB SHEET #1

H. Rivet all link pins thoroughly

(NOTE: If connector link is used be certain that clip opening is facing opposite chain rotation.)

I. Replace drive chain into chain case

J. Check chain tension

K. Check operation

CHAIN REPAIR
UNIT III

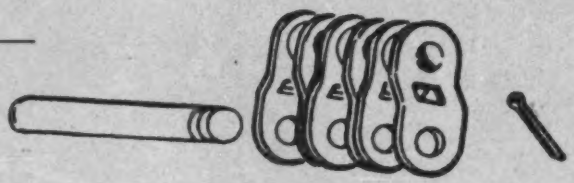
TEST

1. Match terms on the right to the correct definition.

_____a.	Chain having no connection links	1. Cotter pin
_____b.	Hold the outer link in position	2. Connector link
_____c.	Used to hold a connector link on half link pin in place	3. Endless chain
_____d.	Used to connect either a half link or connector link together	4. Clip
_____e.	Chain containing connector links	5. Pin
_____f.	Used to connect a drive chain together	6. Detachable chain
_____g.	Used to shorten a drive chain by replacing a full link with this link	7. Half link

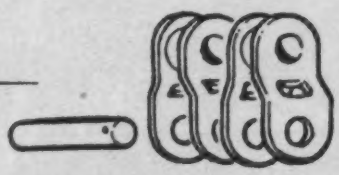
2. Identify the following drive chain links.

a. _____

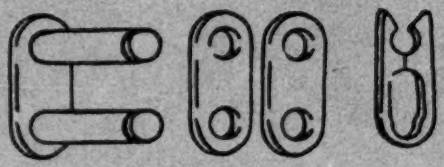


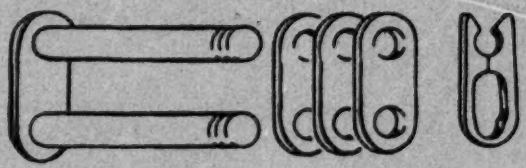
b. _____

c. _____



d. _____

e. _____ 

f. _____ 

3. Name two types of drive chains.

a.

b.

4. Identify the following parts of a drive chain.

a.

b.

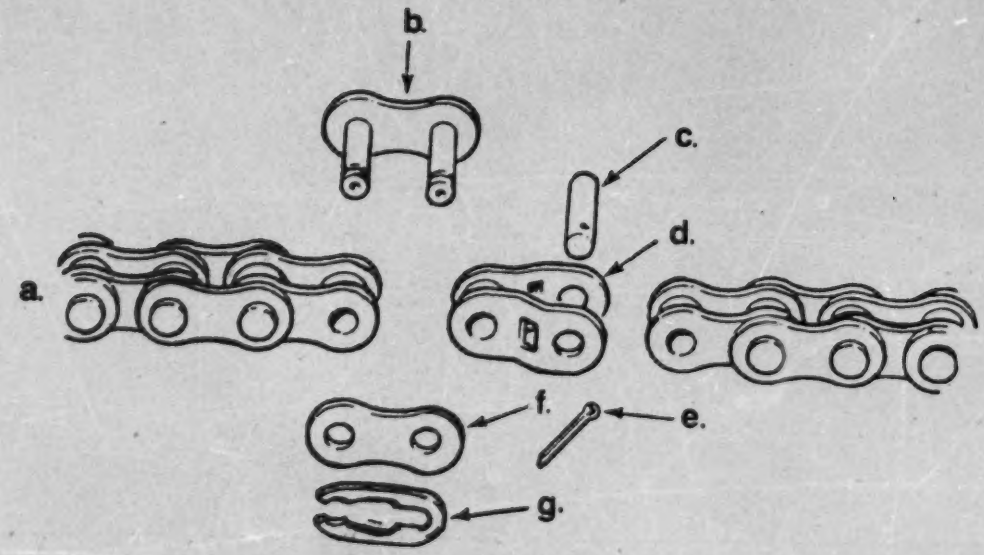
c.

d.

e.

f.

g.



5. Demonstrate the ability to repair any single, double or triple drive chain.

   (NOTE: If this activity has not been accomplished prior to the test, ask the instructor when it should be completed.)

CHAIN REPAIR
UNIT III

ANSWERS TO TEST

1. a. 3
   b. 4
   c. 1
   d. 5
   e. 6
   f. 2
   g. 7
2. a. Triple half link
   b. Single connector link
   c. Double half link
   d. Single half link
   e. Double connector link
   f. Triple connector link
3. a. Endless
   b. Detachable
4. a. Complete chain section
   b. Connector link
   c. Single link pin
   d. Half link
   e. Cotter pin
   f. Outer link
   g. Clip
5. Evaluated to the satisfaction of the instructor.

DRIVE AXLES
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to repair and replace any part of a typical drive axle. The student should be able to determine when sprocket replacement should be necessary. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical drive axle assembly to the correct definition.
2. Name two types of drive sprockets.
3. Name two types of drive axles.
4. Name four causes for sprocket failure.
5. Identify all the main parts of a typical drive axle when given a picture illustrating the parts.
6. Demonstrate the ability to:
   a. Disassemble a typical drive axle assembly.
   b. Reassemble a typical drive axle assembly.

DRIVE AXLES
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheets
- G. Give test
- H. Review test with student

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1a--Internal Drive Type Sprocket
  2. TM 1b--Tooth Type Sprocket
  3. TM 2--Main Parts of a Typical Drive Sprocket

D. Job sheets

1. Job Sheet #1--Disassemble a Typical Drive Axle Assembly

2. Job Sheet #2--Reassemble a Typical Drive Axle Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

DRIVE AXLES
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Drive axle--A hollow or solid shaft which connects to the drive chain by a sprocket and drives the track

B. Drive sprockets--Connected to the drive axle and used to turn the track

C. Teeth--Portion of the drive sprocket that inserts into or receives a raised portion of track to turn the track

D. Seal--Rubber washer device used to seal the chain case where the drive axle enters to eliminate oil leakage

E. Spline--Portion on the drive axle which is grooved to receive the chain case drive sprocket

F. Flange--Plate that secures the drive sprocket to the drive axle

II. Types of drive sprockets

A. Internal drive type (Transparency 1a)

B. Tooth type (Transparency 1b)

III. Types of drive axles

A. Solid shaft

B. Hollow shaft

IV. Causes for drive sprocket failure

A. Lack of lubrication

(NOTE: Snow lubricants.)

B. Missing track inserts which cause chipped or broken teeth

C. Track misalignment causing wear to sprockets

D. Bent drive axle

INFORMATION SHEET

V. Main parts of a typical drive axle (Transparency 2)

A. Axle

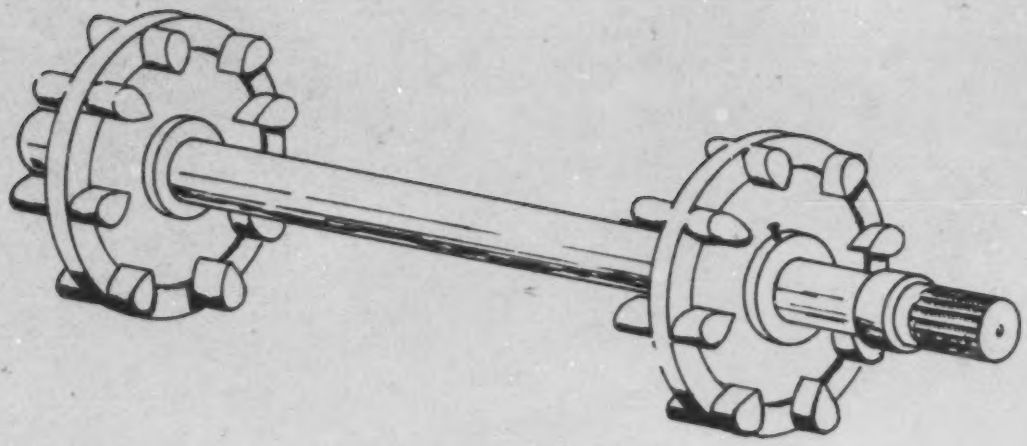
B. Flange

C. Sprocket

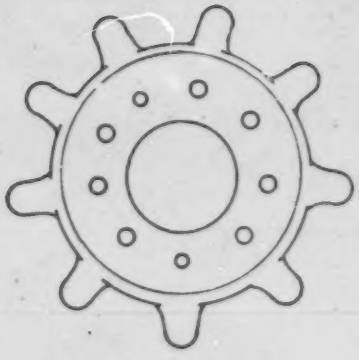
D. Seal

E. Bearing

INTERNAL DRIVE TYPE SPROCKET ON AXLE



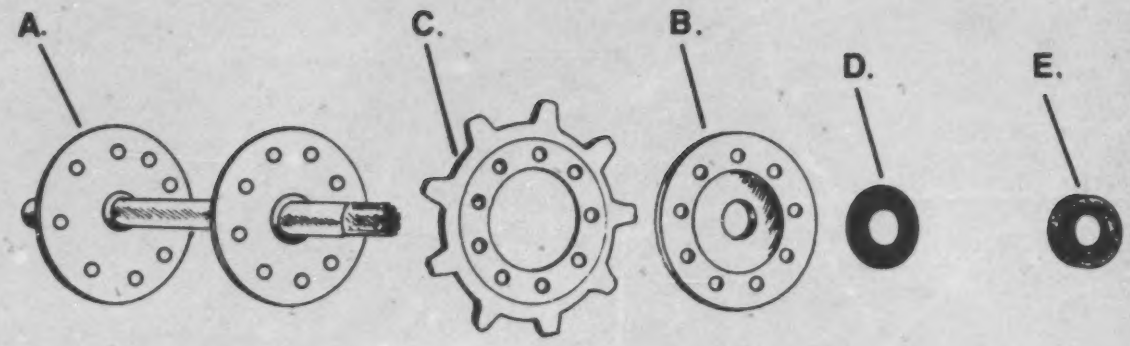
TM 1a



TOOTH TYPE SPROCKET

TM 1b

MAIN PARTS OF A TYPICAL DRIVE AXLE



A. Axle
B. Flange
C. Sprocket
D. Seal
E. Bearing

DRIVE AXLES
UNIT I

JOB SHEET #1--DISASSEMBLE A TYPICAL DRIVE AXLE ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Bearing puller

E. Standard and phillips screwdriver

F. Vise

II. Procedure

A. Drain oil from chain case

B. Remove chain case or chain case inspection cover from snowmobile to expose sprockets

C. Remove nut, bolt or cotter pin holding sprocket onto drive axle

D. Remove sprocket from spline of drive axle

E. Support back end of snowmobile so that the track can be loosened or removed (if applicable)

F. Loosen all bolts supporting the track

G. Remove slide rail or boggie wheel assembly

H. Remove bearing support opposite chain case

I. Slide axle opposite chain case and remove from frame

J. Clamp axle into vise and pull off bearings with puller

K. Remove seals

L. Remove flange from sprockets and remove sprockets

M. Inspect bearings, seals and sprockets for damage

N. Clean all parts for reassembly

DRIVE AXLES
UNIT I

JOB SHEET #2--REASSEMBLE A TYPICAL DRIVE AXLE ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Bearing driver set

E. Standard screwdriver set

F. Seals (if necessary)

G. Sprockets (if necessary)

H. Vise

II. Procedure

A. Install sprockets and flange onto drive axle

B. Install seals

C. Drive bearings onto drive axle with bearing driver

D. Insert drive axle into frame

E. Install bearing support on side opposite chain case

F. Install boggie wheels or slide suspension system

G. Reinstall rear axle and track

H. Slip drive chain sprocket onto spline of axle

I. Reinstall drive chain

J. Install chain case cover

K. Fill chain case with oil to the proper level

L. Align and adjust track

M. Check operation

DRIVE AXLES
UNIT I

TEST

1. Match terms on the right to the correct definition.

___ a.	Connected to the drive axle and used to turn the track	1. Seal
___ b.	Metal plate that secures the drive sprocket to the drive axle	2. Teeth
___ c.	Rubber washer device used to seal the chain case where the drive axle enters to eliminate oil leakage	3. Drive sprockets
___ d.	Portion on the drive axle which is grooved to receive the chain case drive sprocket	4. Drive axle
___ e.	Portion of the drive sprocket that inserts into or receives a raised portion of track to turn the track	5. Spline
___ f.	A hollow or solid shaft which connects to the drive chain by a sprocket and drives the track	6. Flange

2. Name two types of drive sprockets.
   a.
   b.

3. Name two types of drive axles.
   a.
   b.

4. Name four causes of sprocket failure.
   a.
   b.
   c.
   d.

5. Identify all the main parts of a typical drive axle assembly.

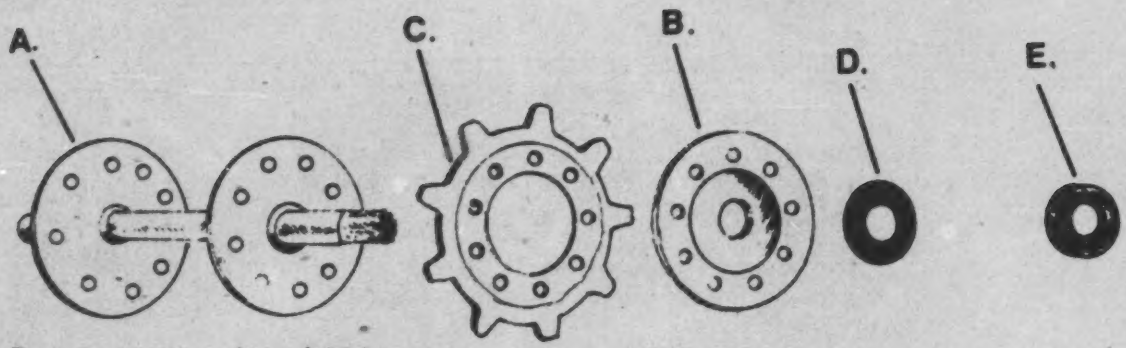
   a.

   b.

   c.

   d.

   e.



6. Demonstrate the ability to:

   a. Disassemble a typical drive axle assembly.

   b. Reassembly a typical drive axle assembly.

   (NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

DRIVE AXLES
UNIT I

ANSWERS TO TEST

1. a. 3
   b. 6
   c. 1
   d. 5
   e. 2
   f. 4
2. a. Internal drive type
   b. Tooth type
3. a. Solid shaft type
   b. Hollow shaft type
4. a. Lack of lubrication
   b. Missing track inserts
   c. Track misalignment
   d. Bent drive axle
5. a. Axle
   b. Flange
   c. Sprocket
   d. Seal
   e. Bearing
6. Evaluated to the satisfaction of the instructor.

REAR AXLES
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to remove and replace a typical rear axle assembly and all of its components. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical rear axle assembly.
2. Name three causes of rear axle sprocket failure.
3. Name three causes of rear axle bearing failure.
4. Identify all the main parts of a rear axle assembly when given an illustration.
5. Demonstrate the ability to:
   a. Disassemble a typical rear axle and its components.
   b. Reassemble a typical rear axle and its components.

REAR AXLES
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information sheet
- C. Make transparencies
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheets
- G. Give test
- H. Review test with student

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency Master #1--Main Parts of a Rear Axle Assembly
- D. Job sheets
  1. Job Sheet #1--Disassemble a Typical Rear Axle Assembly

2. Job Sheet #2--Reassemble a Typical Rear Axle Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

REAR AXLES
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Rear axle--A solid or hollow shaft which connects the link plates and is used to control track tension and also to guide the track alignment

B. Link plates--Used to connect the rear axle to the frame and allow the suspension to flex with the weight of the rider

C. Spring--Used to apply pressure to the link plate to stiffen and lighten the flexibility of the suspension

D. Rear sprockets--Connects to the rear axle and are used as idlers to control track tension and track alignment

E. Flange--Metal plate that secures the rear sprockets to the rear axle

F. Rear bearings--Inserted into the link plates and are used to eliminate friction on the rear axle

G. Rear seal--Used to hold grease in the rear link plates so that the bearings will remain lubricated.

II. Causes of sprocket failure to the rear axle

A. Track misalignment

B. Missing track inserts causing broken or chipped teeth

C. Bent rear axle

III. Rear axle bearing failure

A. Lack of lubrication to bearings

B. Bearings submerged in water and stored for the summer causing them to pit

C. Bent rear axle

IV. Main parts of a typical rear axle (Transparency 1)

A. Rear axle

INFORMATION SHEET

B. Flange

C. Bearing

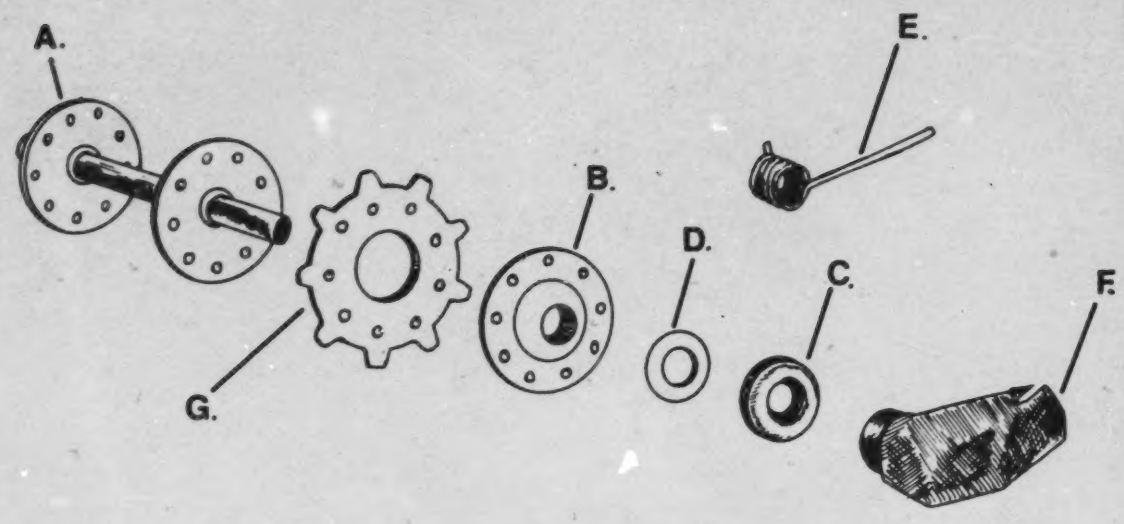
D. Seal

E. Spring

F. Link plate

G. Sprocket

MAIN PARTS OF A TYPICAL REAR AXLE



A. Rear Axle
B. Flange
C. Bearing
D. Seal
E. Spring
F. Link Plate
G. Sprocket

REAR AXLES
UNIT II

JOB SHEET #1--DISASSEMBLE A TYPICAL REAR AXLE ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Bearing puller

E. Standard and phillips screwdriver sets

F. Vise

II. Procedure

A. Raise and support rear end of snowmobile

B. Remove link springs from link plate

C. Loosen track tension

D. Remove link plate from snowmobile frame

E. Drop rear axle assembly from snowmobile

F. Remove seals from link plates

G. Remove link plates from rear axle

H. Clamp rear axle in vise

I. Remove bearing from rear axle with bearing puller

J. Remove flange and sprocket from axle

K. Check bearings for wear

L. Check sprockets for wear

M. Clean all parts for reassembly

REAR AXLES
UNIT II

JOB SHEET #2--REASSEMBLE A TYPICAL REAR AXLE ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Bearing driver

E. Standard and phillips screwdriver sets

F. Vise

II. Procedure

A. Install sprockets and flanges on axle

B. Install seals on axle

C. Install bearing on axle with bearing driver

D. Reinstall link plates

E. Insert assembly into track

F. Hook link plates to snowmobile frame

G. Hook up link springs

H. Adjust track tension

I. Adjust track alignment

J. Check operation

REAR AXLES
UNIT II

TEST

1. Match terms on the right to the correct definition

___ a. Used to apply pressure to the link plate, to stiffen and lighten the flexibility of the suspension

___ b. Connects to the rear axle and are used as idlers to control track tension and track alignment

___ c. A solid or hollow shaft which connects to the link plates and is used to control track tension and also to guide the track alignment

___ d. Inserted into the link plates and are used to eliminate friction on the rear axle

___ e. Used to connect the rear axle to the frame and allow the suspension to flex with the weight of the rider

___ f. Metal plate that secures the rear sprockets to the rear axle

___ g. Used to hold grease in the rear link plates so that the bearing will remain lubricated

1. Link plates
2. Rear sprockets
3. Rear seal
4. Rear axle
5. Flange
6. Rear bearing
7. Spring

2. Name three causes of rear axle sprocket failure.

   a.

   b.

   c.

3. Name three causes for rear axle bearing failure.

   a.

   b.

   c.

4. Identify all the main parts of a rear axle assembly.

   a.

   b.

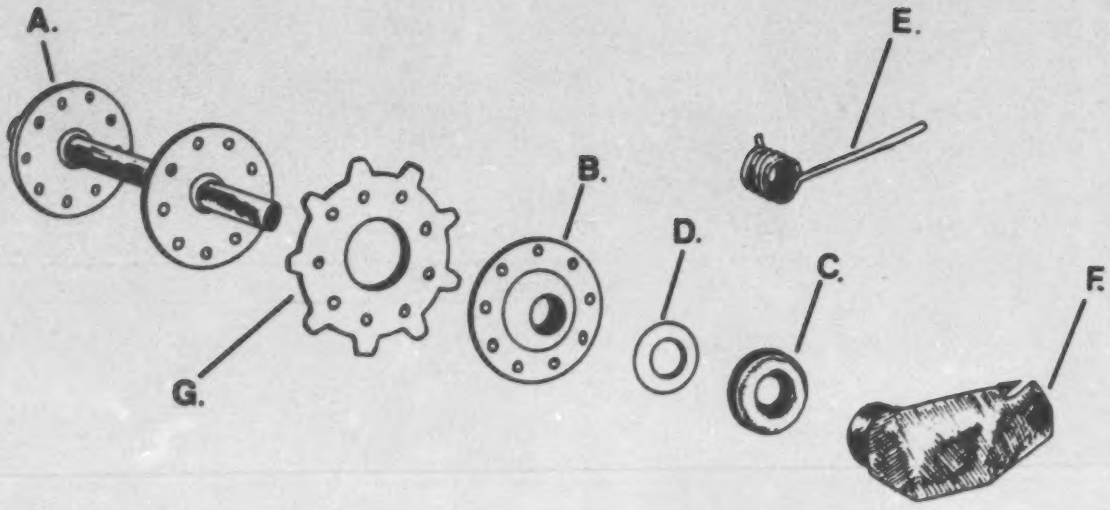
   c.

   d.

   e.

   f.

   g.



5. Demonstrate the ability to:

   a. Disassemble a typical rear axle and its components.

   b. Reassemble a typical rear axle and its components.

   (NOTE: If these activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

REAR AXLES
UNIT II

ANSWERS TO TEST

1. a. 7
   b. 2
   c. 4
   d. 6
   e. 1
   f. 5
   g. 3
2. a. Track misalignment
   b. Missing track inserts causing broken or chipped teeth
   c. Bent rear axle
3. a. Lack of lubrication to bearings
   b. Bearings submerged in water and stored for the summer causing them to pit
   c. Bent rear axle
4. a. Rear axle
   b. Flange
   c. Bearing
   d. Seal
   e. Spring
   f. Link plate
   g. Sprocket
5. Evaluated to the satisfaction of the instructor.

BOGIE WHEELS
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to repair or replace any component of a bogie wheel suspension system. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical bogie wheel assembly.
2. Name two types of bogie wheel assemblies.
3. Name two types of bearings used on a typical bogie wheel assembly.
4. Identify all main parts of a bogie wheel assembly when given an illustration showing the parts.
5. Demonstrate the ability to:
   a. Replace springs on any given bogie wheel assembly.
   b. Replace bearings and tires on any given bogie wheel assembly.

BOGIE WHEELS
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information sheet
- C. Make transparency
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Discuss procedures outlined in job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency Master #1--Main Parts of a Typical Bogie Wheel Assembly

D. Job sheets

1. Job Sheet #1--Spring Replacement on a Typical Bogie Wheel Assembly

2. Job Sheet #2--Tire and Bearing Replacement on a Typical Bogie Wheel Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

BOGIE WHEELS
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Bogie wheel assembly--Assembly mounted to the snowmobile frame between the top and bottom of the track which is used to support the weight of the rider and to absorb any shock caused by hitting objects while riding the snowmobile

B. Tire--Mounted to a bearing or flange and is usually made of rubber or nylon, and supports the track on top and bottom

C. Cross shaft--Shaft used to support and mount bogie wheel assembly onto the snowmobile frame

(NOTE: Shaft inserts into wheel support tube.)

D. Spring--Used to give the bogie assembly suspension action

E. Bearing--Mounted on the support tubes and used to eliminate friction between support tube and tire

F. Flange--Used to mount the tire to the bearing

II. Types of bogie wheel assemblies

A. Single wheel type

B. Double wheel type

III. Types of bearings used on bogie wheel assemblies

A. Sealed type bearing

B. Non-sealed type bearing

(NOTE: The non-sealed roller bearing needs to be lubricated with grease.)

IV. Main parts of a typical bogie wheel assembly (Transparency 1)

A. Tire

B. Cross shaft

INFORMATION SHEET

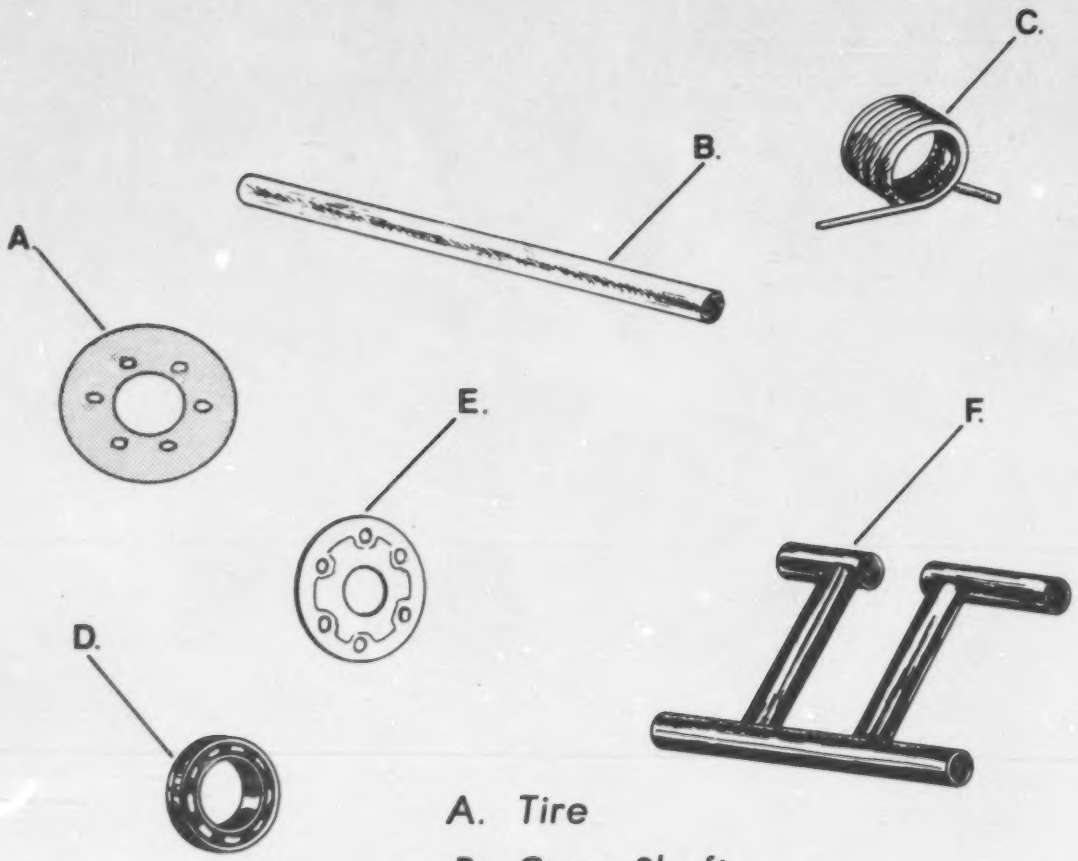
C. Spring

D. Bearing

E. Flange

F. Support tube

MAIN PARTS OF A TYPICAL BOGIE WHEEL ASSEMBLY



A. Tire
B. Cross Shaft
C. Spring
D. Bearing
E. Flange
F. Support Tube

BOGIE WHEELS
UNIT I

JOB SHEET #1--SPRING REPLACEMENT ON A TYPICAL BOGIE WHEEL ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Punch and chisel set

E. Ball peen hammer

F. Vise

II. Procedure

A. Support rear end of snowmobile

B. Remove bogie wheel assembly

(NOTE: It may be necessary to loosen track tension on some models.)

C. Remove cross shaft from bogie wheel assembly by driving out with a punch

D. Clamp support tube into vise and loosen any clamps, tabs or any support that is securing the springs to the support tube

E. Remove springs

F. Replace bogie wheel springs

G. Secure any tabs, clamps or supports that hold the spring to the support tubes

H. Reassemble the entire bogie wheel assembly

I. Install bogie wheel assembly into the snowmobile

J. Check operation

BOGIE WHEELS
UNIT I

JOB SHEET #2--TIRE AND BEARING REPLACEMENT ON A TYPICAL BOGIE WHEEL ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Bearing puller

E. Phillip and standard screwdriver set

F. Vise

G. Bearing driver

II. Procedure

A. Remove bogie wheel assembly from snowmobile

B. Clamp assembly into vise

C. Remove flanges from tires

D. Remove tires from support tube

E. Remove bearings from support tube with puller

F. Install bearing with bearing driver

G. Install tires and flanges

H. Reinstall bogie wheel assembly into snowmobile

I. Check operation

BOGIE WHEELS
UNIT I

TEST

1. Match the terms on the right to the correct definition.

___ a.	Assembly mounted to the snowmobile frame between the top and bottom of the track which is used to support the weight of the rider and to absorb any shock caused by hitting objects while riding the snowmobile	1. Tire 2. Spring 3. Bearing 4. Bogie wheel assembly 5. Flange 6. Cross shaft
___ b.	Mounted to a bearing or flange and is usually made of rubber or nylon and supports the track on top and bottom	
___ c.	Shaft used to support and mount bogie wheel assembly onto snowmobile frame	
___ d.	Used to give the bogie assembly suspension action	
___ e.	Mounted on the support tubes and used to eliminate friction between support tube and tire	
___ f.	Used to mount the tire to the bearing	

2. Name two types of bogie wheel assemblies

   a.

   b.

3. Name two types of bearings used on a typical bogie wheel assembly.

   a.

   b.

4. Identify all main parts of a typical bogie wheel assembly.

   a.

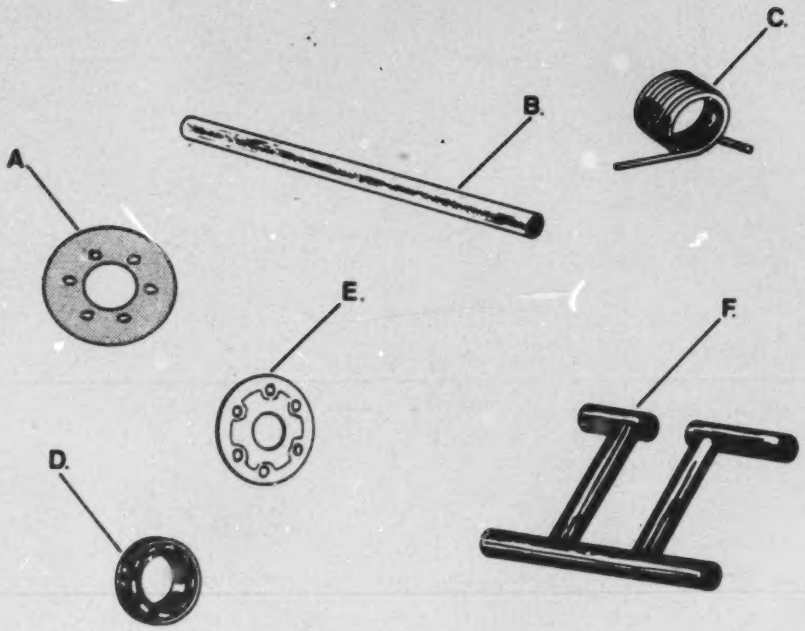
   b.

   c.

   d.

   e.

   f.



5. Demonstrate the ability to:

   a. Replace springs on any given bogie wheel assembly.

   b. Replace bearings and tires on any given bogie wheel assembly.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

BOGIE WHEELS
UNIT I

ANSWERS TO TEST

1. a. 4
   b. 1
   c. 6
   d. 2
   e. 3
   f. 5
2. a. Single wheel type
   b. Double wheel type
3. a. Sealed type bearing
   b. Non-sealed type bearing
4. a. Tire
   b. Cross shaft
   c. Spring
   d. Bearing
   e. Flange
   f. Support tube
5. Evaluated to the satisfaction of the instructor.

SLIDE RAIL SUSPENSION
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to disassemble and reassemble any part on a typical slide rail suspension. The student should be able to identify all main parts of a typical slide rail suspension. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical slide rail suspension.
2. Name two advantages of a slide rail suspension over a bogie wheel suspension.
3. Identify all the main parts of a typical slide rail suspension when given an illustration.
4. Demonstrate the ability to:
   a. Remove a typical slide rail suspension.
   b. Install a typical slide rail suspension.

SLIDE RAIL SUSPENSION
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information sheet
- C. Make transparency
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheets
- G. Give test

II. Student

- A. Read objective
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency Master #1--Main Parts of a Typical Slide Rail Suspension
- D. Job sheets
  1. Job Sheet #1--Remove a Typical Slide Rail Suspension
  2. Job Sheet #2--Install a Typical Slide Rail Suspension

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

SLIDE RAIL SUSPENSION
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Cross shaft--Used to mount the slide rail suspension on the snowmobile chassis

B. Idlers--Used to apply tension to the track and keep the slide rail from hitting the track

C. Springs--Used to give the slide rail suspension action

D. Slider--Usually made of nylon and is guided by inserts in the track

(NOTE: This rail is lubricated by snow.)

E. Runner bars--Used to attach the nylon slide rail

II. Advantages of a slide rail suspension over a bogie wheel suspension

A. Applies more track pressure to the ground

B. Less friction to the track

III. Main parts of a typical slide rail suspension (Transparency 1)

A. Cross shaft

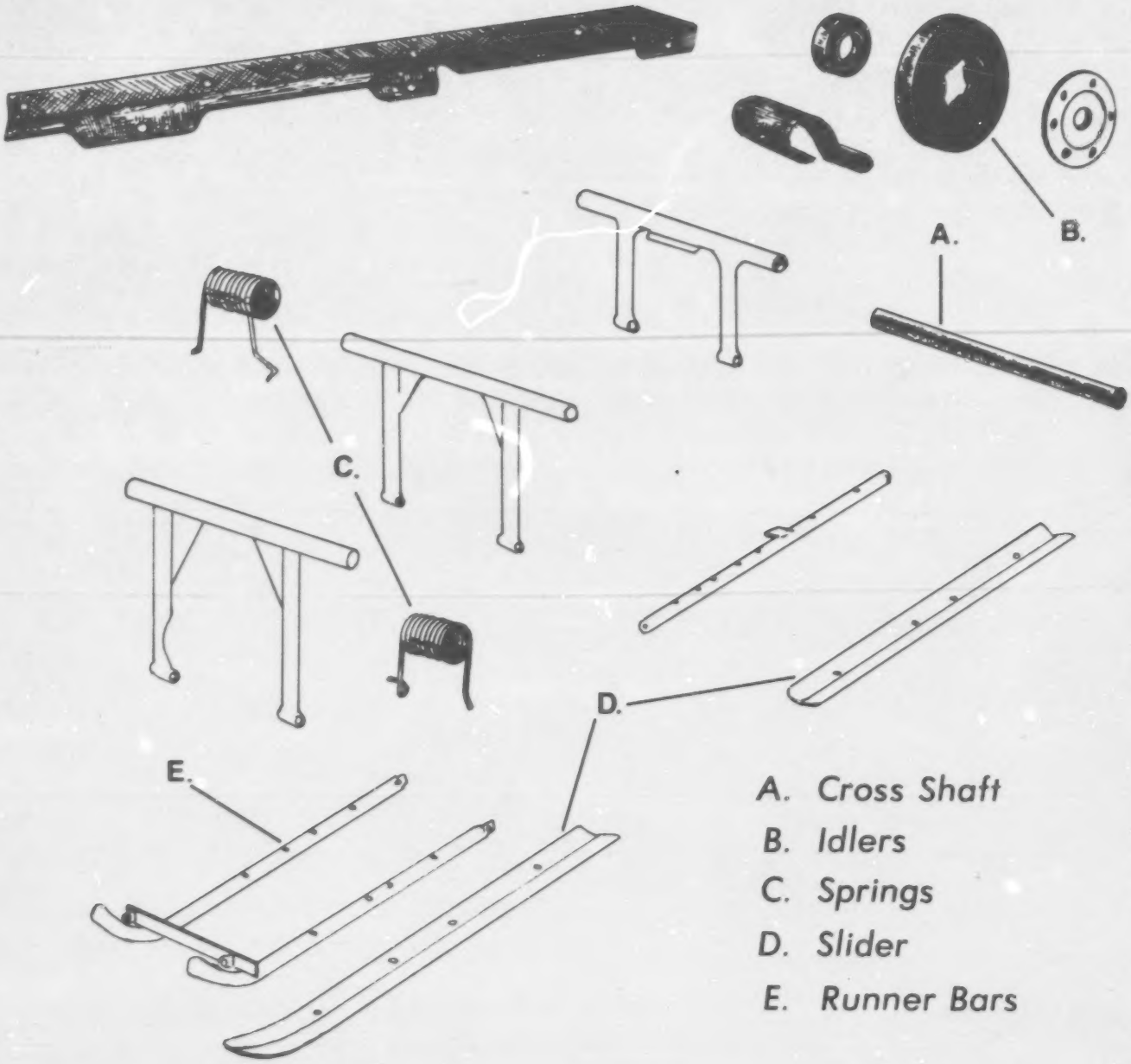
B. Idlers

C. Springs

D. Sliders

E. Runner bars

MAIN PARTS OF A TYPICAL SLIDE RAIL SUSPENSION



A. Cross Shaft
B. Idlers
C. Springs
D. Slider
E. Runner Bars

SLIDE RAIL SUSPENSION
UNIT II

JOB SHEET #1--REMOVE A TYPICAL SLIDE RAIL SUSPENSION

I. Tools and materials needed

A. Combination wrench set

B. 3/8" drive socket set

C. Medium size pry bar

D. Snowmobile with slide suspension

E. Ball peen hammer

II. Procedure

A. Tilt snowmobile on its sides and release tension on the springs using pry bar and hammer (if applicable)

B. Loosen track tension

C. Remove bolts from the cross shaft

D. Pull slide rail suspension from track

E. Inspect slide rails or sliders for wear

F. Inspect shock absorber

G. Clean for reassembly

SLIDE RAIL SUSPENSION
UNIT II

JOB SHEET #2--INSTALL A SLIDE RAIL SUSPENSION

I. Tools and materials needed

A. Combination wrench set

B. 3/8" drive socket set

C. Medium size pry bar

D. Ball peen hammer

E. Slide rail suspension

II. Procedure

A. Insert slide rail unit into snowmobile

B. Bolt front cross shafts to frame

C. Bolt rear cross shafts to frame

D. Hook springs on both sides

E. Tighten track tension according to manufacturer's specifications

F. Align track

G. Test run

SLIDE RAIL SUSPENSION
UNIT II

TEST

1. Match the terms on the right to the correct definition.

___ a.	Usually made of nylon and are guided by inserts in the track	1. Springs
___ b.	Used to apply tension to the track and keep the slide rail from hitting the track	2. Slider
___ c.	Used to give the slide rail suspension action	3. Cross shaft
___ d.	Used to mount the slide rail suspension onto the snowmobile chassis	4. Runner bars
___ e.	Used to attach the nylon slide rail	5. Idlers

2. Name two advantages of a slide rail suspension over a bogie wheel suspension.

   a.

   b.

3. Identify all the main parts of a typical slide assembly.

   a.

   b.

   c.

   d.

   e.

4. Demonstrate the ability to:

   a. Remove a typical slide rail suspension.

   b. Install a typical slide rail suspension.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SLIDE RAIL SUSPENSION
UNIT II

ANSWERS TO TEST

1. a. 2
   b. 5
   c. 1
   d. 3
   e. 4
2. a. Applies more track pressure to the ground
   b. Less friction to the track
3. a. Cross shaft
   b. Idlers
   c. Springs
   d. Sliders
   e. Runner bars
4. Evaluated to the satisfaction of the instructor.

SHOE TYPE BRAKE SERVICING
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to remove and replace a typical shoe type brake on any given snowmobile. The student should be able to adjust shoe type brakes. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Name four causes of shoe type brake failure.
2. Identify all the main parts of a typical shoe type brake assembly when given a drawing illustrating the parts.
3. Demonstrate the ability to remove, replace and adjust a typical shoe type brake assembly.

SHOE TYPE BRAKE SERVICING
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

A. Provide the student with objective sheet

B. Provide the student with information sheet

C. Make transparency

D. Discuss unit and specific objectives

E. Discuss information sheet

F. Demonstrate procedures outlined in job sheet

G. Give test

II. Student

A. Read objectives

B. Study information sheet

C. Complete job sheet

D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

A. Objectives

B. Information sheet

C. Transparency Master #1--Main Parts of a Typical Shoe Type Brake

D. Job Sheet #1--Remove, Replace and Adjust a Typical Shoe Type Brake Assembly

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

SHOE TYPE BRAKE SERVICING
UNIT I

INFORMATION SHEET

I. Four causes of shoe type brake failure

A. Broken brake cable

B. Brake shoe oil soaked

C. Brake not adjusted properly

D. Brake shoe worn out

II. Main parts of a typical shoe type brake assembly (Transparency 1)

A. Shoe

B. Brake arm

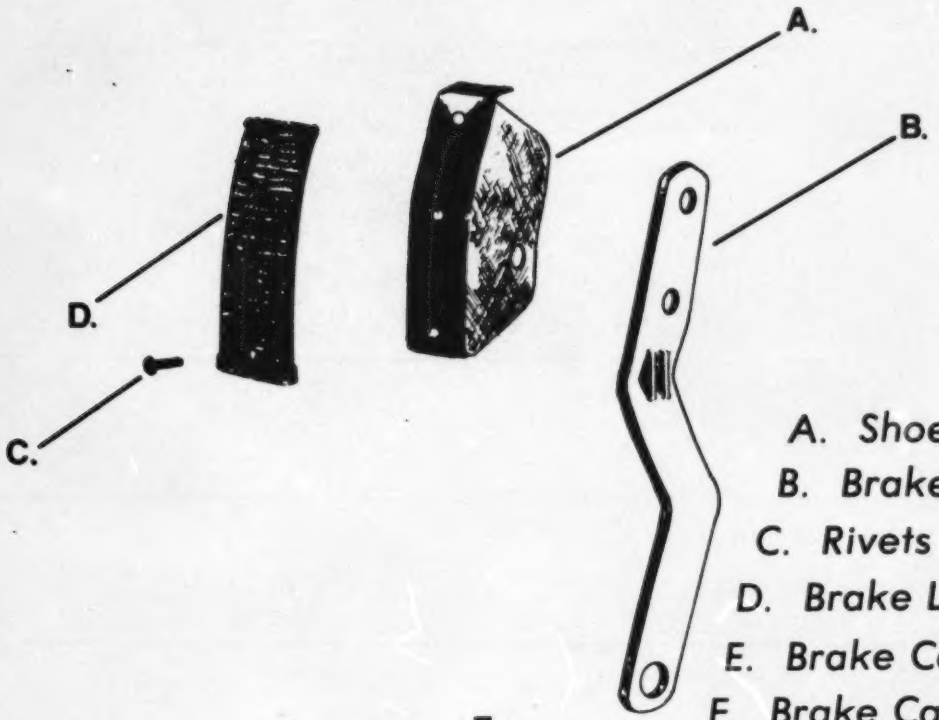
C. Rivets

D. Brake cable

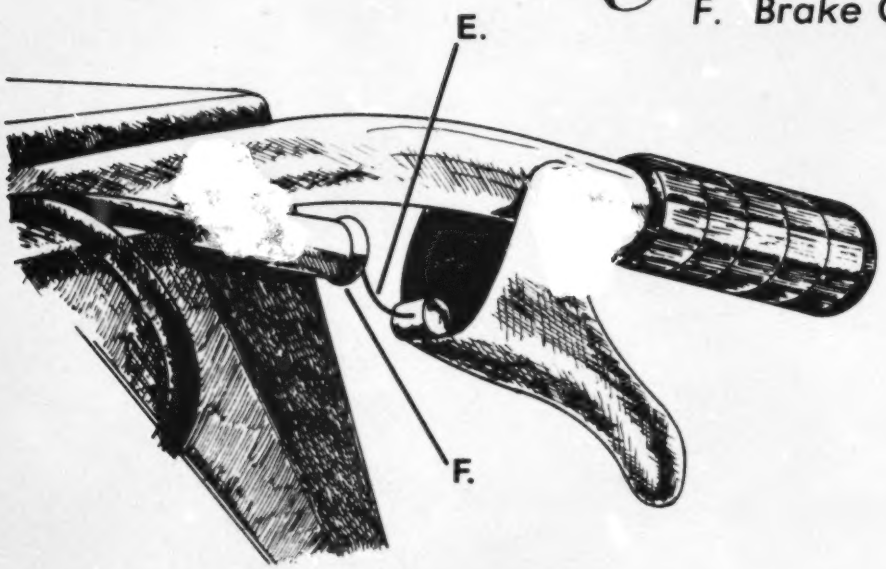
E. Brake lining

F. Brake cable housing

MAIN PARTS OF A TYPICAL SHOE TYPE BRAKE ASSEMBLY



A. Shoe
B. Brake Arm
C. Rivets
D. Brake Lining
E. Brake Cable
F. Brake Cable Housing



SHOE TYPE BRAKE SERVICING
UNIT I

JOB SHEET #1--REMOVE, REPLACE AND ADJUST A TYPICAL SHOE TYPE BRAKE ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Chisel and punch set

E. Ball peen hammer

F. Rivets (if applicable)

G. Vise

II. Procedure

A. Remove brake cable from handle bars

B. Remove brake cable from brake arm

C. Remove shoe from brake lever

D. Remove brake pad from shoe with chisel

E. Replace brake pad on shoe with rivets

F. Install brake shoe on brake lever

G. Install brake cable assembly

H. Adjust cable so that there is a maximum of 1/4" free play in brake handle

SHOE TYPE BRAKE SERVICING
UNIT I

TEST

1. Name four causes of shoe type brake failure.

   a.

   b.

   c.

   d.

2. Identify all the main parts of a typical shoe type brake assembly.

   a.

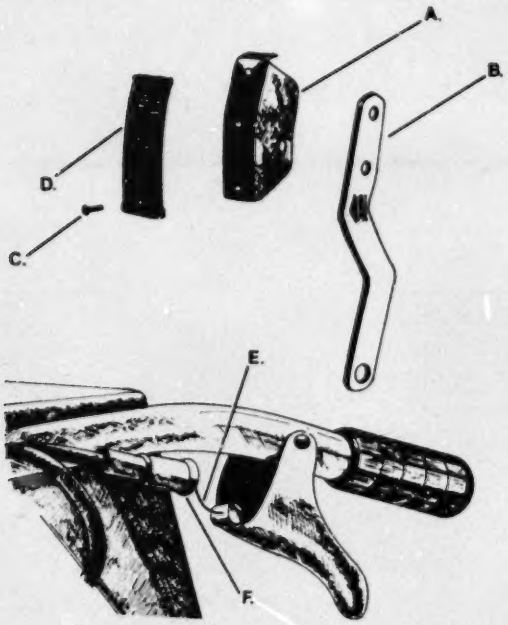
   b.

   c.

   d.

   e.

   f.



3. Demonstrate the ability to remove, replace and adjust a typical brake assembly.

   (NOTE: If this activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

SHOE TYPE BRAKE SERVICING
UNIT I

ANSWERS TO TEST

1. a. Broken brake cable
   b. Brake shoe oil soaked
   c. Brake not adjusted properly
   d. Brake shoe worn out
2. a. Shoe
   b. Brake arm
   c. Rivets
   d. Brake lining
   e. Brake cable
   f. Brake cable housing
3. Evaluated to the satisfaction of the instructor.

DISC TYPE BRAKE SERVICING
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to repair and adjust a typical disc type brake assembly. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical disc brake assembly.
2. Name two types of disc brakes used on a snowmobile.
3. Identify all the main parts of a typical brake assembly when given a drawing illustrating the parts.
4. Describe when punks should be replaced.
5. Demonstrate the ability to:
   a. Disassemble a typical disc brake assembly.
   b. Adjust a typical disc brake.

DISC TYPE BRAKE SERVICING
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information sheet
- C. Make transparency
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objective sheet
- B. Information sheet
- C. Transparency Master #1--Main Parts of a Typical Disc Brake Assembly
- D. Job sheets
  1. Job Sheet #1--Disassemble a Typical Disc Brake Assembly
  2. Job Sheet #2--Adjust a Typical Disc Brake

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

DISC TYPE BRAKE SERVICING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Puck--Round shaped material that is forced against the disc to cause a friction which slows down the snowmobile

B. Disc--Attached directly or indirectly to driven pulley to stop movement of the track when pressure is applied with the brake unit

C. Calipers--Assembly which holds the pucks and is equipped with a lever for applying pressure to the brake disc

D. Cable--Attaches to the handle on the hand bar, and to the lever on the calipers to apply pressure to the disc

E. Housing--Used to guide the brake cable and eliminate any friction or sticking of the cable

F. Self adjusting brake caliper--Racheting type gear to decrease the clearance between the puck and the disc

II. Types of disc brake units

A. Manually adjusted

B. Self adjusting

III. Main parts of a typical disc brake (Transparency 1)

A. Pucks

B. Disc

C. Calipers

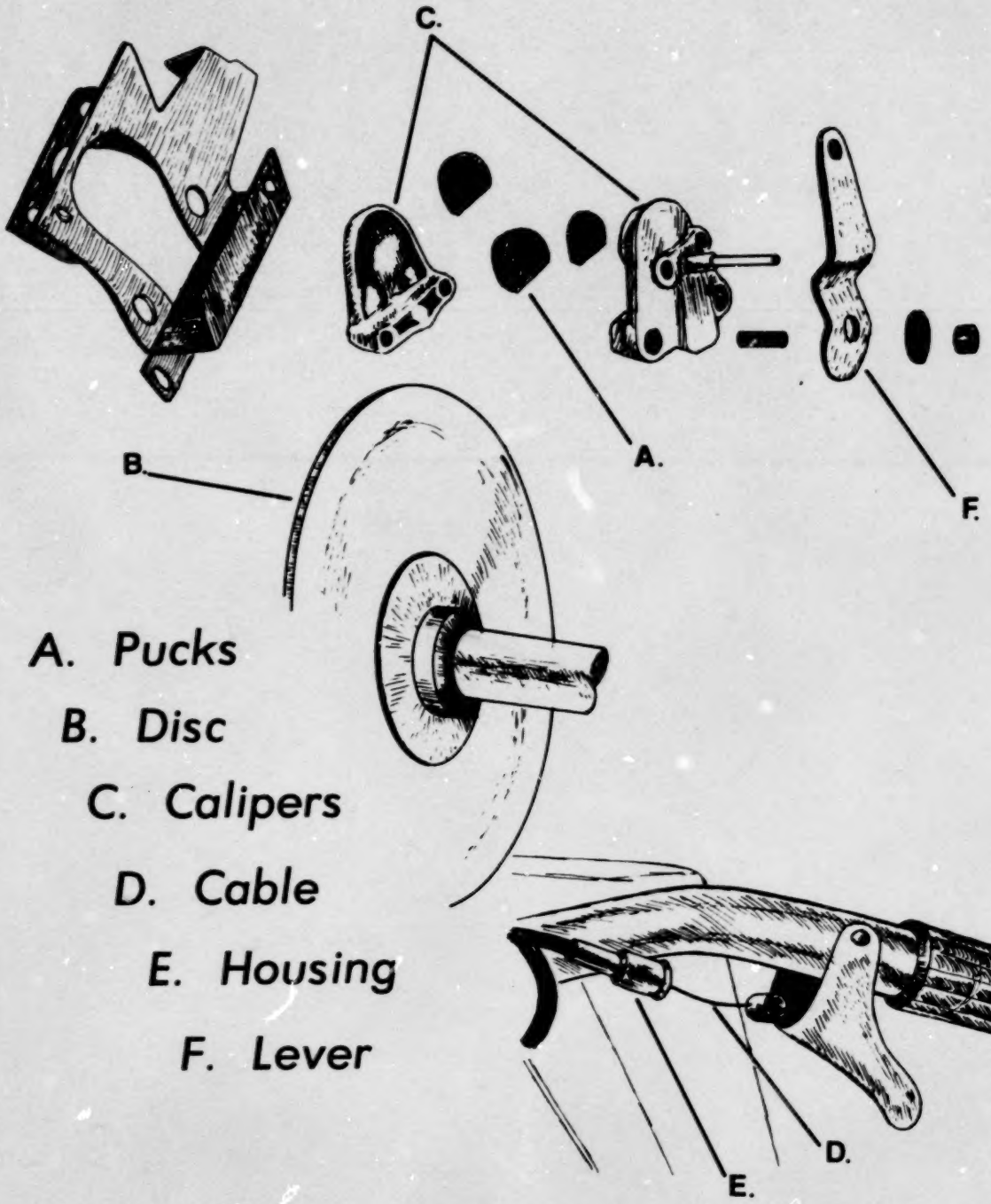
D. Cable

E. Housing

F. Lever

IV. Replacement of puck is necessary when the brake handle has an excessive amount of free play after it has been fully adjusted

MAIN PARTS OF A TYPICAL DISC BRAKE UNIT



A. Pucks

B. Disc

C. Calipers

D. Cable

E. Housing

F. Lever

DISC TYPE BRAKE SERVICING
UNIT II

JOB SHEET #1--DISASSEMBLE A TYPICAL DISC BRAKE ASSEMBLY

I. Tools and materials

A. Combination wrench set

B. 3/8" drive socket set

C. Standard and phillips screwdriver set

D. Side cutters

E. Disc brake unit on snowmobile

II. Procedure

A. Remove brake cable from caliper lever

B. Remove pins or bolts mounting caliper to snowmobile

C. Loosen tension on caliper assembly from snowmobile

D. Remove caliper assembly from snowmobile

E. Disassemble caliper and remove pucks

F. Reinstall pucks

G. Reverse disassembly procedure and reinstall disc brake unit

JOB SHEET #2--ADJUST A TYPICAL DISC BRAKE

I. Tools and materials needed

A. 3/8" drive socket set

B. Combination wrench set

C. Standard screwdriver set

II. Procedure

A. Apply pressure to brake handle

(NOTE: If the handle moves freely for more than 1/4 of an inch without applying pressure to the disc the brake needs to be adjusted.)

B. Adjustment is made by tightening the nut or bolt on the caliper assembly

C. Adjust caliper so there is a maximum of 1/8" free play when pressure is applied to the brake lever

DISC TYPE BRAKE SERVICING
UNIT II

TEST

1. Match terms on the right to the correct definition.

___ a. Used to guide the brake cable and eliminate any friction or sticking of the cable

___ b. Round shaped material that is forced against the disc to cause a friction which slows down the snowmobile

___ c. Nut or bolt used to adjust the clearance between the puck and the disc

___ d. Assembly which holds the puck and is equipped with a lever for applying pressure to the brake disc

___ e. Racheting type gear to decrease the clearance between the pucks and the disc

___ f. Attaches to the handle on the handle bar, and to the lever on the calipers to apply pressure to the disc

___ g. Attached directly or indirectly to driven pulley to stop movement of the track when pressure is applied with the brake unit

1. Pucks
2. Manually adjusted brakes
3. Cable
4. Self adjusting brakes
5. Disc
6. Housing
7. Calipers

2. Name two types of disc brakes used on snowmobiles.

a.

b.

3. Identify all main parts of a typical disc brake assembly.

   a.

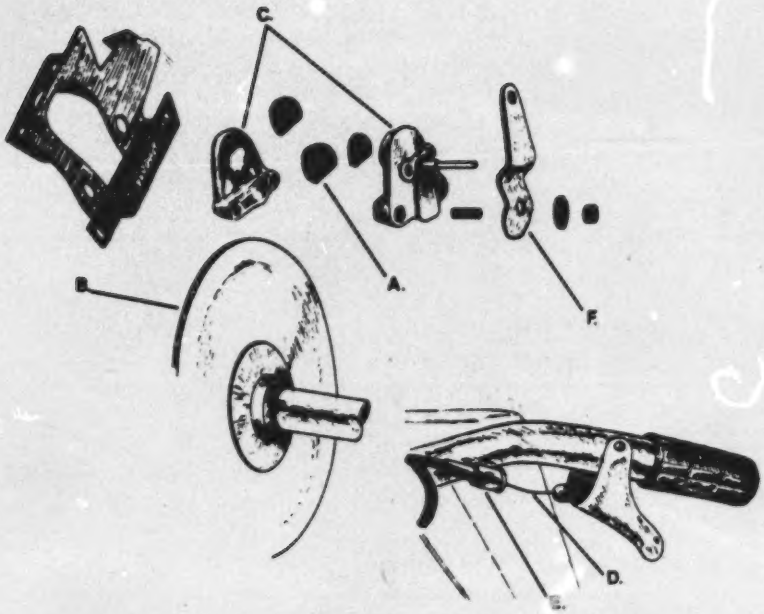
   b.

   c.

   d.

   e.

   f.



4. Describe when pucks should be replaced.

5. Demonstrate the ability to:

   a. Disassemble a typical disc brake assembly.

   b. Adjust a typical disc brake.

   (NOTE: If these activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

DISC TYPE BRAKE SERVICING
UNIT II

ANSWERS TO TEST

1. a. 6
   b. 1
   c. 2
   d. 7
   e. 4
   f. 3
   g. 5
2. a. Manually adjusted
   b. Self adjusting
3. a. Pucks
   b. Disc
   c. Calipers
   d. Cable
   e. Housing
   f. Lever
4. Puck replacement is necessary when the brake handle has an extreme amount of free play after it has been fully adjusted.
5. Evaluated to the satisfaction of the instructor.

HYDRAULIC BRAKE SERVICING
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to repair any typical hydraulic brake unit. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a typical hydraulic brake unit.
2. Identify all the main parts of a typical hydraulic brake unit, when given a drawing illustrating the parts.
3. Demonstrate the ability to:
   a. Disassemble a typical hydraulic brake unit.
   b. Bleed a typical hydraulic brake unit.

HYDRAULIC BRAKE SERVICING
UNIT III

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information sheet
- C. Make transparency
- D. Discuss unit and specific objectives
- E. Discuss information sheet
- F. Demonstrate procedures outlined in job sheets
- G. Give test

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheet
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency Master #1--Main Parts of a Typical Hydraulic Brake Unit
- D. Job sheets
  1. Job Sheet #1--Disassemble a Typical Hydraulic Brake Unit
  2. Job Sheet #2--Bleed a Typical Hydraulic Brake Unit

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

HYDRAULIC BRAKE SERVICING
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Puck--"D" or round shaped material that is forced against the disc to cause a friction which slows down the snowmobile

B. Disc--Attached directly or indirectly to the driven pulley to stop movement of the track when pressure is applied with the brake unit

C. Calipers--Assembly which holds the pucks and is equipped with a hydraulic hose which attaches to the master cylinder assembly on the handle bars

D. Hose--Used to transfer fluid from the master cylinder to the caliper assembly

E. Master cylinder--Is attached to the handle bars and is a reservoir for brake fluid

F. Plunger--Forces fluid from the master cylinder through the hose to the calipers to supply pressure to the pucks

G. Handle--Used as a lever to apply pressure to the plunger which forces the fluid to the calipers

H. Bleeder valve--Small outlet in caliper used to release any air that might be trapped in the calipers

I. Brake fluid--Fluid used to force the pucks against the disc

II. Parts of a typical hydraulic brake unit

A. Brake fluid

B. Bleeder valve

C. Calipers

D. Hose

E. Master cylinder

F. Plunger

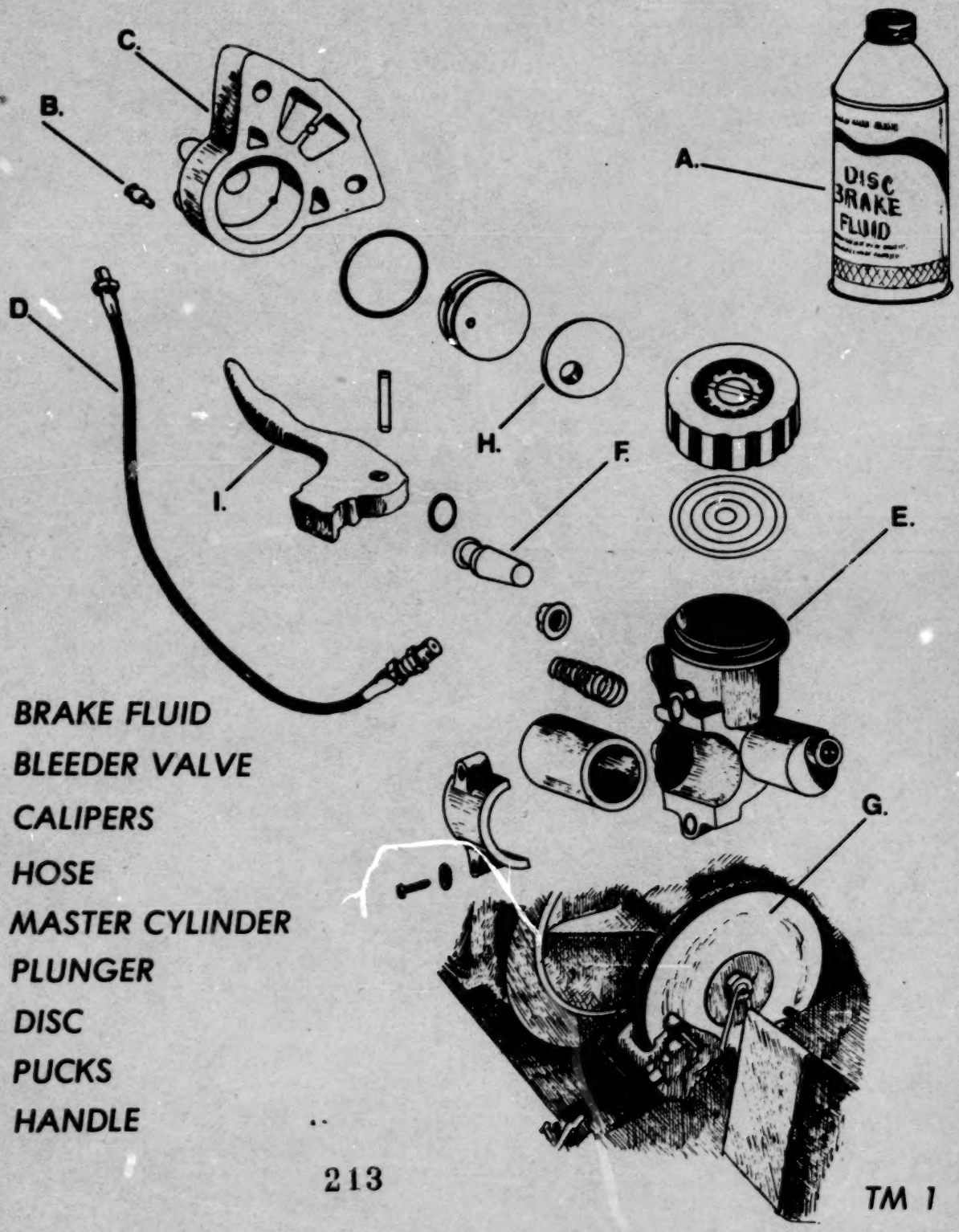
INFORMATION SHEET

G. Disc

H. Pucks

I. Handle

Main Parts of a Typical Hydraulic Brake System



A. BRAKE FLUID
B. BLEEDER VALVE
C. CALIPERS
D. HOSE
E. MASTER CYLINDER
F. PLUNGER
G. DISC
H. PUCKS
I. HANDLE

TM 1

HYDRAULIC BRAKE SERVICING
UNIT III

JOB SHEET #1--DISASSEMBLE A TYPICAL HYDRAULIC BRAKE UNIT

I. Tools and materials needed

A. Combination wrench set

B. 3/8" drive socket set

C. Standard and phillips screwdriver set

D. Small ignition wrench set

E. Hydraulic brake unit on snowmobile

F. Rags

II. Procedure

A. Remove hose from caliper assembly

(NOTE: Be certain not to spill fluid on snowmobile.)

B. Remove calipers assembly from chassis

C. Remove pucks from calipers

D. Inspect pucks

E. Remove master cylinder assembly from handle bars

F. Drain fluid from cylinder

G. Remove handle from master cylinder

H. Remove plunger from master cylinder

I. Clean all parts for reassembly

J. Reverse procedures of reassembly

HYDRAULIC BRAKE SERVICING
UNIT III

JOB SHEET #2--BLEED A TYPICAL HYDRAULIC BRAKE UNIT

I. Tools and materials needed

- A. Combination wrench set
- B. 3/8" drive socket set
- C. Hydraulic brake fluid
- D. Small ignition wrench set
- E. Rags
- F. Wooden wedge

II. Procedure

- A. Check fluid level on master cylinder and fill if necessary
- B. Reinstall master cylinder cap
- C. Remove caliper assembly from the snowmobile
- D. Locate the bleeder valve
- E. Position calipers higher than the master cylinder with hose attached
- F. Insert a wedge between the pucks to take up all slack
- G. Pump handle on master cylinder and hold so that pressure is applied
- H. Keeping a constant pressure on handle release bleeder valve to release air
- I. Repeat procedure until all air is removed from calipers assembly
- J. Reinstall calipers
- K. Wipe off all spilled fluid (if necessary)

HYDRAULIC BRAKE SERVICING
UNIT III

TEST

1. Match terms on the right to the correct definition.

___ a. "D" or round shaped material that is forced against the disc to cause a friction which slows down the snowmobile

___ b. Attached directly or indirectly to the driven pulley to stop movement of the track when pressure is applied with the brake unit

___ c. Assembly which holds the pucks and is equipped with a hydraulic hose which attaches to the master cylinder assembly on the handle bars

___ d. Used to transfer fluid from the master cylinder to the caliper assembly

___ e. Is attached to the handle bars and is a reservoir for brake fluid

___ f. Forces fluid from the master cylinder through the hose to the calipers to supply pressure to the pucks

___ g. Used as a lever to apply pressure to the plunger which forces the fluid to the calipers

___ h. Small outlet in caliper used to release any air that might be trapped in the calipers

___ i. The fluid used to force the pucks against the disk

1. Puck
2. Hose
3. Handle
4. Brake fluid
5. Calipers
6. Plunger
7. Master cylinder
8. Disk
9. Bleeder valve

2. Identify all the main parts of a hydraulic brake unit.

   a.

   b.

   c.

   d.

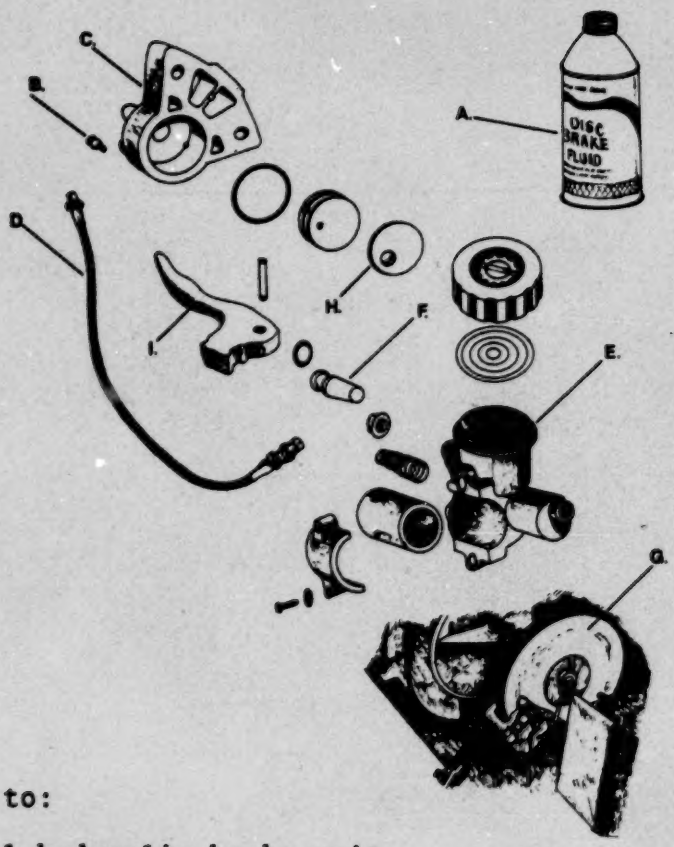
   e.

   f.

   g.

   h.

   i.



3. Demonstrate the ability to:

   a. Disassemble a typical hydraulic brake unit.

   b. Bleed a typical hydraulic brake unit.

   (NOTE: If these activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

HYDRAULIC BRAKE SERVICING
UNIT III

ANSWERS TO TEST

1. a. 1
   b. 8
   c. 5
   d. 2
   e. 7
   f. 6
   g. 3
   h. 9
   i. 4
2. a. Brake fluid
   b. Bleeder valve
   c. Calipers
   d. Hose
   e. Master cylinder
   f. Plunger
   g. Disk
   h. Pucks
   i. Handle
3. Evaluated to the satisfaction of the instructor.

TRACK
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to adjust track tension on any given snowmobile. The student should be able to singe the track and replace any inserts. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with track assemblies to the correct definition.
2. Name two safety factors to remember when singeing tracks.
3. Identify three types of tracks when given an illustration.
4. Demonstrate the ability to:
   a. Adjust track tension.
   b. Singe the track.
   c. Replace track inserts.

TRACK
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

A. Provide student with objective sheet

B. Provide student with information and job sheets

C. Make transparencies

D. Discuss unit and specific objectives

E. Discuss information and job sheets

F. Demonstrate procedures outlined in job sheets

G. Give test

H. Review test with student

II. Student

A. Read objectives

B. Study information sheet

C. Complete job sheets

D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

A. Objectives

B. Information sheet

C. Transparency masters

1. TM 1--Rubber Track with Steel Rods

2. TM 2--Cleated Track

3. TM 3--Internal Drive Type Track

D. Job sheets

1. Job Sheet #1--Replace Track Inserts

2. Job Sheet #2--Singe the Track

3. Job Sheet #3--Adjust Track Alignment

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

TRACK
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Track--Rubber belting with either cleats attached or solid molded track with inserts to receive the sprockets and drive the snowmobile

B. Cleat--U-shaped iron bar that attaches to rubber belt to give traction in the snow and also to receive the sprockets which turn the track

C. Insert--Metal clip used to eliminate wear to the rubber on the track by inserting into the track

D. Track tension--Tightness of the track

E. Track alignment--Equal distance on both sides of snowmobile frame

F. Cords--Nylon cords which are molded into the track to give it strength

G. Singe--Burning or melting of the nylon ends that protrude from the track's edge as the track begins to wear

H. Rods--Steel rods molded into the track to make it rigid and give the track strength

II. Safety factors to remember when singeing tracks

A. Use only a small propane torch

B. Be sure there are no flammable fluids or substances in the area or on the track

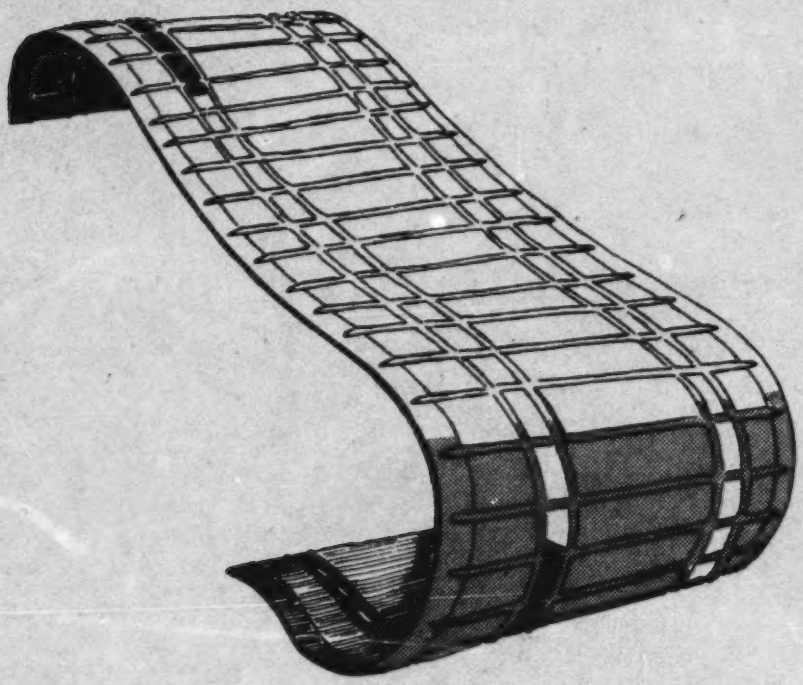
III. Types of tracks

A. Rubber track with steel rods molded in (Transparency 1)

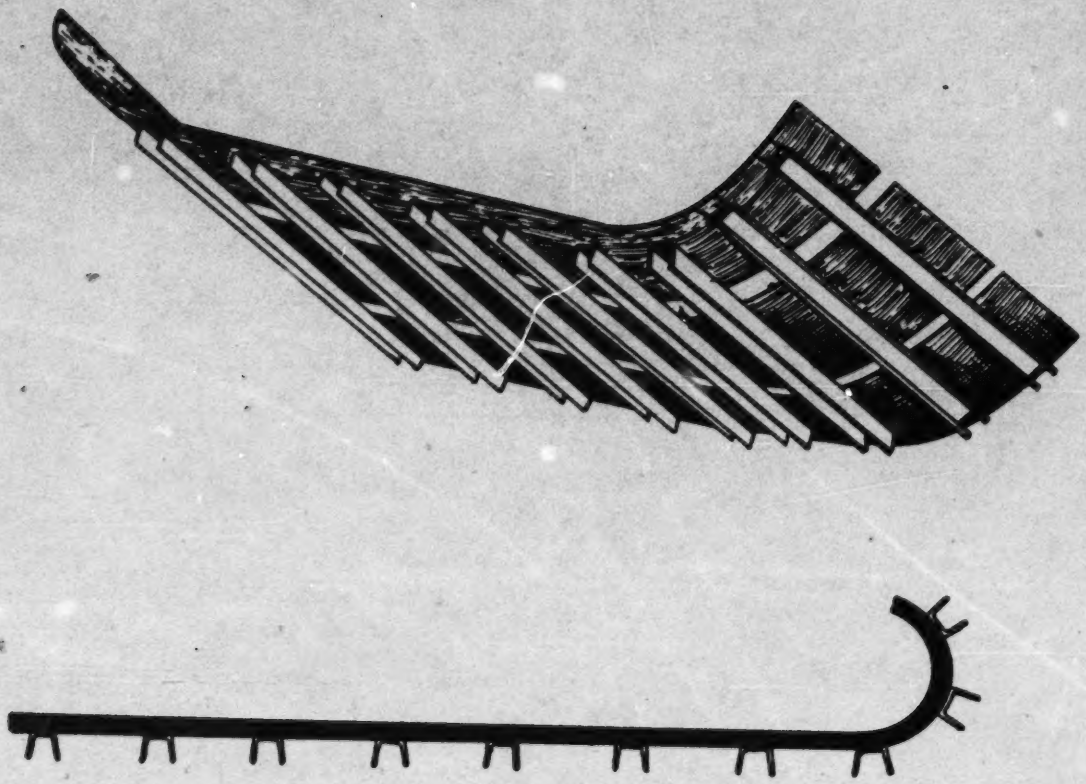
B. Cleated track (Transparency 2)

C. Internal drive type track (Transparency 3)

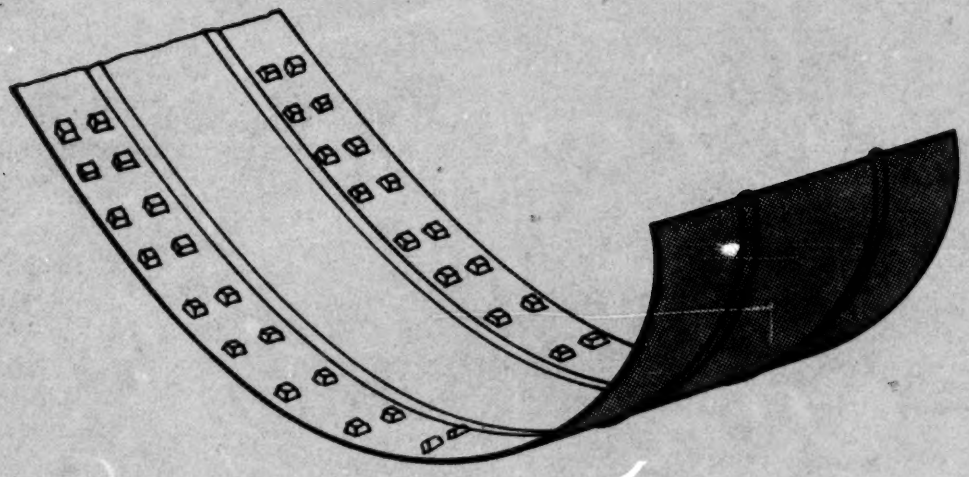
RUBBER TRACK WITH MOLDED IN STEEL RODS

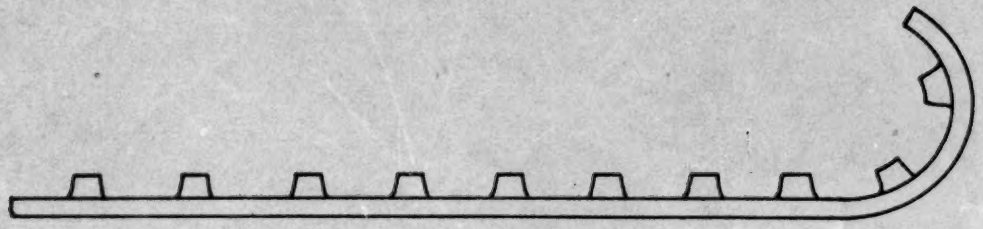


CLEATED TRACK



INTERNAL DRIVE TRACK





TRACK
UNIT I

JOB SHEET #1--REPLACE TRACK INSERTS

I. Tools and materials needed

A. Snowmobile (with track)

B. Track inserts

C. Track insert tool (if applicable)

D. Two medium size hammers

E. Adjustable locking pliers (vise grip)

F. Combination wrench set

G. 3/8" drive socket set

II. Procedure

A. Loosen track tension on snowmobile

B. Tilt snowmobile on its side

C. Locate track inserts that are severely worn or missing

D. Place track insert on track

E. Use special track insert tool (if applicable)

F. Crimp inserts into place with locking pliers

G. Flatten by placing one hammer on inside of track and hitting inner ends with other hammer

H. Rotate track and be sure that all inserts are replaced

I. Realign track and adjust track tension

TRACK
UNIT I

JOB SHEET #2--SINGE THE TRACK

I. Tools and materials needed

A. Snowmobile

B. Frayed track

C. Small propane torch

D. Jack stand or hoist

II. Procedure

A. Support rear end of snowmobile with jack stand or hoist

B. Be certain there are no flammable substances or liquids on snowmobile or in the area

C. Start snowmobile

D. Light torch and burn edges that are frayed

E. Rotate the track by using the engine power and burn all edges

F. Do the same on both sides of snowmobile

G. Recheck track for frayed edges

H. Repeat procedures if necessary

TRACK
UNIT I

JOB SHEET #3--ADJUST TRACK ALIGNMENT

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. Jack stand or hoist

D. 3/8" drive socket set

II. Procedure

A. Support rear end of snowmobile

B. Run snowmobile so that the track revolves

(NOTE: Be sure that no one is in line with the rear of the snowmobile.)

C. Check distance between link plates and track edge

D. Loosen link plates or track adjustment bolts

E. Run snowmobile so that the track revolves

F. Check track alignment

G. If track is off to the left side tighten left side adjuster bolt and loosen right side adjuster bolt

H. Reverse procedure if track is offset to right side

I. Tighten track to proper tension

J. Check operation

TRACK
UNIT I

TEST

1. Match terms on the right with the correct definition.

___ a. U-shaped iron bar that attaches to rubber belt to give traction in the snow and also receive the sprockets which turn the track

___ b. Metal clip used to eliminate wear to the rubber on the track by inserting into the track

___ c. Steel rods molded into the track to make it rigid and give the track strength

___ d. Tightness of the track

___ e. Nylon cords which are molded into the track to give it strength

___ f. Equal distance on both sides of snowmobile frame

___ g. Burning or melting of the nylon ends that protrude from the track's edge as the track begins to wear

___ h. Rubber belting with either cleats attached or solid molded track with inserts to receive the sprockets and drive the snowmobile

1. Track tension
2. Cords
3. Singe
4. Track
5. Track alignment
6 Rods
7. Insert
8. Cleat

2. Name two safety factors to remember when singeing tracks.

a.

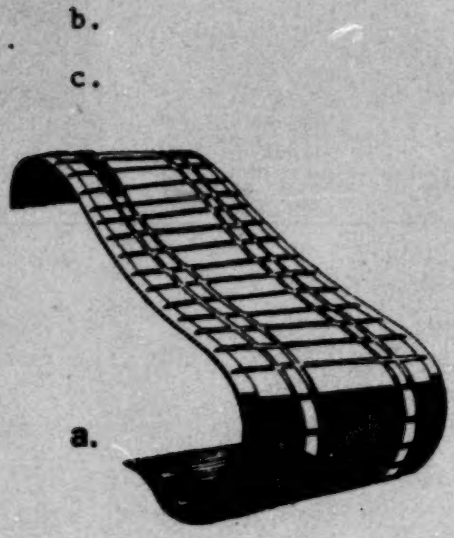
b.

3. Identify three types of tracks when given an illustration.

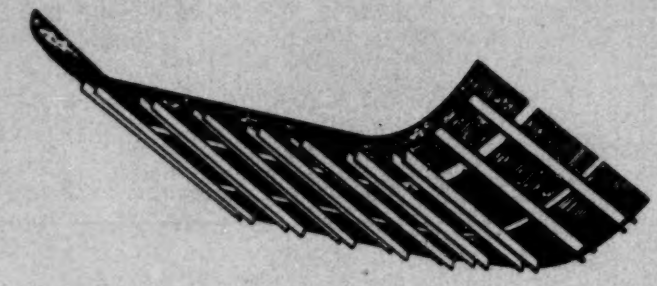
   a.

   b.

   c.



a.



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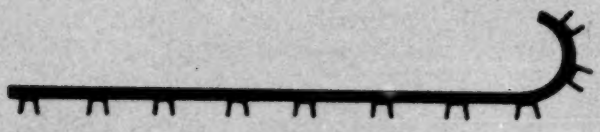

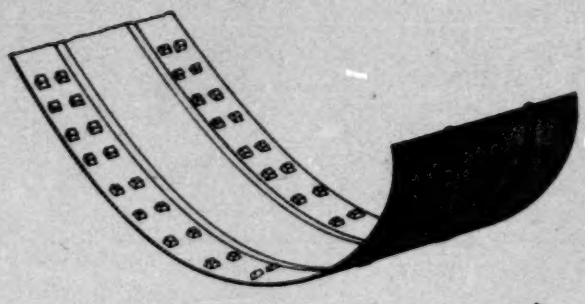

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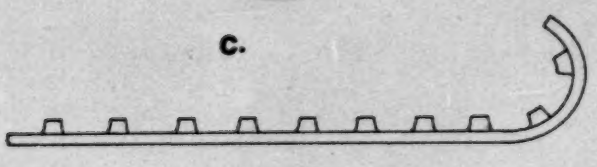


4. Demonstrate the ability to:

   a. Adjust track tension.

   b. Singe the track.

   c. Replace track inserts.

   (NOTE: If these activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

TRACK
UNIT I

ANSWERS TO TEST

1. a. 8
   b. 7
   c. 6
   d. 1
   e. 2
   f. 5
   g. 3
   h. 4
2. a. Use only a small propane torch
   b. Be sure there are not any flammable fluids or substances in the area or on the track
3. a. Rubber track with steel rods molded in
   b. Cleated track
   c. Internal drive type track
4. Evaluated to the satisfaction of the instructor.

TRACK REPLACEMENT
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to remove and replace any track on any given snowmobile. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Name six causes of track failure.
2. Demonstrate the ability to:
   a. Remove a typical track assembly.
   b. Replace a typical track assembly.

TRACK REPLACEMENT
UNIT II

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide students with objective sheet
- B. Provide students with information sheet
- C. Discuss unit and specific objectives
- D. Discuss information and job sheets
- E. Demonstrate procedures outlined in job sheets
- F. Give test
- G. Review test with student

II. Student

- A. Read objectives
- B. Study information sheet
- C. Complete job sheets
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Job sheets
  1. Job Sheet #1--Remove a Typical Track Assembly
  2. Job Sheet #2--Replacement of a Typical Track Assembly

D. Test

E. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

TRACK REPLACEMENT
UNIT II

INFORMATION SHEET

I. Causes of track failure

A. Frozen bearings on bogie wheels

B. Track misaligned for a long period of time

C. Tearing caused by running over sharp objects

D. Not repairing broken cleats

E. Worn sprockets

F. Normal wear

TRACK REPLACEMENT
UNIT II

JOB SHEET #1--REMOVE A TYPICAL TRACK ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Standard and phillips screwdriver sets

II. Procedure

A. Raise and support rear end of snowmobile

B. Remove link springs from link plates

C. Loosen track tension

D. Remove link plates from snowmobile frame

E. Drop rear axle from snowmobile

F. Remove slide rail (if applicable)

G. Remove bogie wheel assemblies (if applicable)

H. Loosen bearing support holding front axle to frame

I. Remove front axle

J. Remove track from snowmobile

TRACK REPLACEMENT
UNIT II

JOB SHEET #2--REPLACEMENT OF A TRACK ASSEMBLY

I. Tools and materials needed

A. Snowmobile

B. Combination wrench set

C. 3/8" drive socket set

D. Standard and phillips screwdriver sets

II. Procedure

A. Insert track into snowmobile frame

B. Insert drive axle into frame

C. Secure drive axle to frame

D. Reinstall bogie wheel assemblies or slide rail suspension system

E. Install rear axle

F. Hook up rear link plates

G. Install all seals on front and rear axles

H. Tighten track tension

I. Check track alignment

TRACK REPLACEMENT
UNIT II

TEST

1. Name six causes of track failure.

   a.

   b.

   c.

   d.

   e.

   f.

2. Demonstrate the ability to:

   a. Remove a typical track assembly.

   b. Replace a typical track assembly.

   (NOTE: If these activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

TRACK REPLACEMENT
UNIT II

ANSWERS TO TEST

1. a. Frozen bearings on bogie wheels
   b. Track misaligned for a long period of time
   c. Tearing caused by running over sharp objects
   d. Not repairing broken cleats
   e. Worn sprockets
   f. Normal wear
2. Evaluated to the satisfaction of the instructor.

SHOCK ABSORBERS
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to remove shock absorbers. The student should be able to replace shock absorbers. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Name two places where shock absorbers may be used on a snowmobile.
2. Name two purposes of a shock absorber.
3. Name two types of shock absorbers.
4. Demonstrate the ability to remove and replace a typical shock absorber assembly.

SHOCK ABSORBERS
UNIT I

SUGGESTED ACTIVITIES

I. Instructor

- A. Provide student with objective sheet
- B. Provide student with information sheet
- C. Make transparencies
- D. Discuss objective sheet
- E. Provide student with job sheet
- F. Demonstrate procedures outlined in job sheet
- G. Give test

II. Student

- A. Read objective sheet
- B. Study information sheet
- C. Complete job sheet
- D. Take test

INSTRUCTIONAL MATERIALS

I. Included in this unit

- A. Objectives
- B. Information sheet
- C. Transparency masters
  1. TM 1--Shock Absorber Mounted on Ski Assembly
  2. TM 2--Shock Absorber Mounted on Slide Suspension
- D. Job Sheet #1--Shock Absorber Removal and Replacement

E. Test

F. Answers to test

II. References

A. *Polaris Shop Manuals*, 1973-1976, Polaris Industries, A Textron Corp., Roseau, Minnesota 56751.

B. *Ski-Doo Shop Manuals*, 1967-1976, Bombardier Ltd., 4504 West Superior Street, Duluth, Minnesota 55806.

SHOCK ABSORBERS
UNIT I

INFORMATION SHEET

I. Places where shock absorbers may be used on a snowmobile

   A. Skis (Transparency 1)

   B. Slide suspension system (Transparency 2)

II. Purposes of a shock absorber

   A. To stiffen the ride within a slide rail suspension system

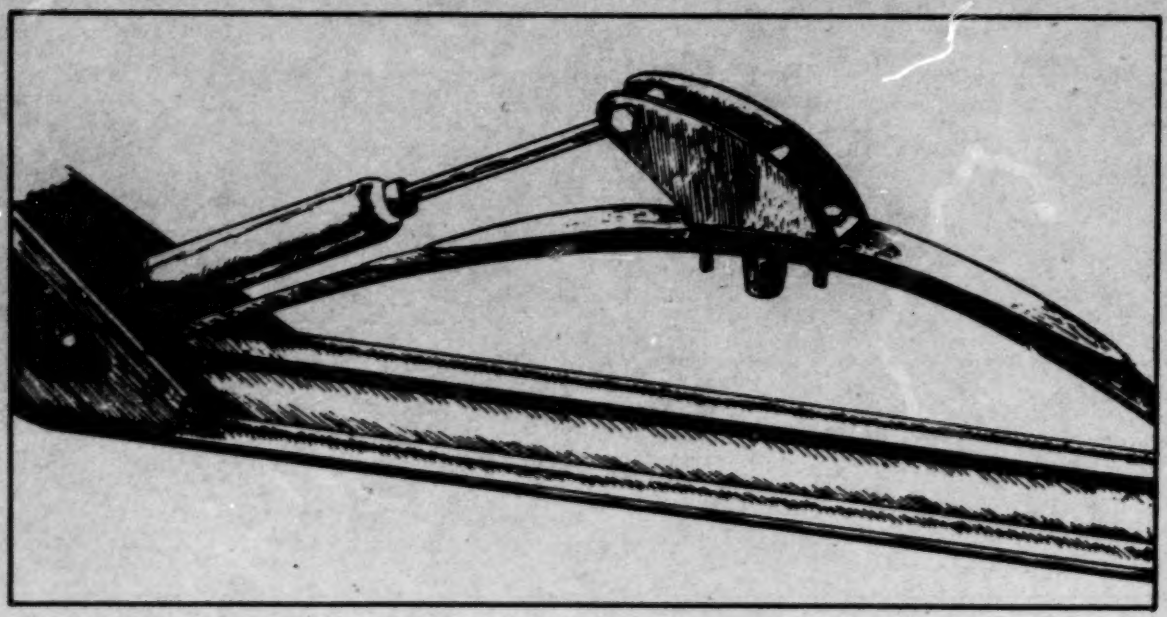
   B. To apply down pressure to the ski for better steering control

III. Types of shock absorbers

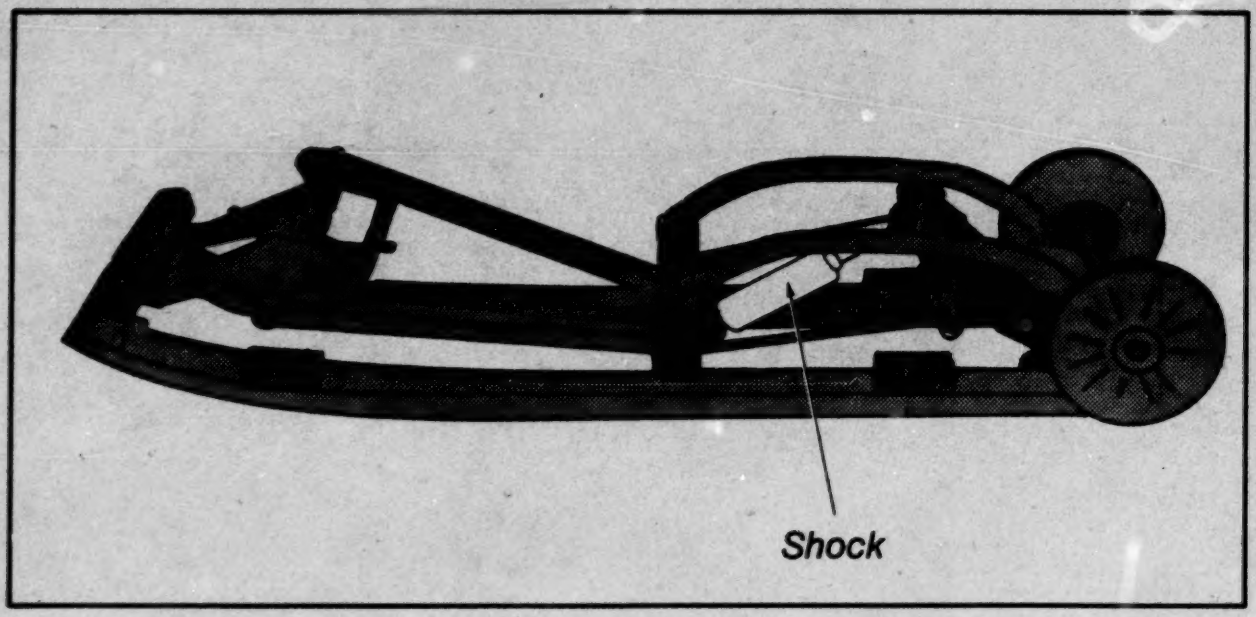
   A. Adjustable sealed

   B. Non-adjustable sealed

SHOCK MOUNTED ON SKI ASSEMBLY



SHOCK MOUNTED ON SLIDE RAIL SUSPENSION



SHOCK ABSORBERS
UNIT I

JOB SHEET #1--SHOCK ABSORBER REMOVAL AND REPLACEMENT

I. Tools and materials needed

A. Combination wrench set

B. Side cutters

C. Pin punch

D. Hammer

E. Cotter pins (medium size and length)

F. Pliers

II. Procedure

A. Remove a shock absorber from any snowmobile ski by removing cotter pins and shock absorber pins

(NOTE: On some models it may be necessary to remove bolts that secure the shock absorber to the ski.)

B. Remove bolts or pins from shock absorber on slide suspension

(NOTE: It may be necessary to remove the slide suspension on some models to be able to remove the shock absorber assembly.)

C. Check the operation of the shock absorber

D. Reinstall shock absorber assembly by reversing the disassembly procedure

(NOTE: Be certain that new cotter pins are installed and bent over properly.)

SHOCK ABSORBERS
UNIT I

TEST

1. Name two places in which shock absorbers may be used on a snowmobile.

   a.

   b.

2. Name two purposes of a shock absorber.

   a.

   b.

3. Name two types of shock absorbers.

   a.

   b.

4. Demonstrate the ability to remove and replace a typical shock absorber assembly.

   (NOTE: If this activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

SHOCK ABSORBERS
UNIT I

ANSWERS TO TEST

1. a. Slide suspension system

   b. Skis

2. a. To stiffen the ride within a slide rail suspension system

   b. To apply down pressure to the ski for better steering control

3. a. Adjustable sealed

   b. Non-adjustable sealed

4. Evaluated to the satisfaction of the instructor.

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